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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. THE MID-WEST NORTH ISLAND HILL COUNTRY.

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GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

Cocksfoot (*Dactylis glomerata*).

COCKSFOOT has been called "king" of the grasses, and under certain environmental conditions related to the soil and to pasture-management one cannot deny regal place to it. Regal place, however, in any one paddock may be claimed for most grasses, succession to dominance being governed almost entirely by environmental conditions set up by the farmer himself.

In the preceding article of this series (*Journal* for May last) the writer aimed to show how conditions of environment influenced the persistence or the running-out of perennial rye-grass on hill country. The ideal or acme of perfection in grassland—whether on hill or low country—is a mixed sward with perennial rye-grass as the dominant element. When perennial rye-grass is king the grassland farmer should be a prosperous and happy subject. Cocksfoot, in the writer's opinion, ranks second to perennial rye-grass, and when cocksfoot is present as a dominant in the sward the farmer may still reckon on a high-yielding, good-quality pasture, although he should firmly bear in mind that an increasing dominance of cocksfoot must be regarded as a falling-away from the possible ideal.

In the early stage of primary forest burns on the hill country perennial rye-grass is dominant (Fig. 62, May *Journal*). As the soil-fertility falls and the soil-surface conditions become harder, owing to loss of humus and ash, perennial rye-grass begins to dwindle and to fall off in production. At this stage one finds cocksfoot coming to the fore as the dominant of the hill-country pasture (Fig. 64). Many thousands of acres of hill country have been so managed that this desirable sward has been largely retained, and where this has been accomplished under ordinary grassland grazing-conditions much praise must be given to the farmer himself (Fig. 65).

Over the wide range of the hill-country soils we see cocksfoot in varying degrees of dominance, from the almost pure stands of vigorous, healthy plants to small, insignificant, stunted, dried-up, weak plants just persisting among danthonia or brown-top, or in a general run-out weedy pasture of catsear, hawkweed, rib-grass, self-heal, &c.

Wherever the fertility is fairly high, and where rotational grazing in contradistinction to close and continuous grazing has been adopted, cocksfoot remains a permanent constituent of the sward (Fig. 66). In the early bush-burn days the spelling of the burn pasture was a very common practice, and on these areas cocksfoot took charge, as indicated by the large quantities of cocksfoot-seed that was harvested from the bush country, particularly so in Taranaki. On Banks Peninsula spelling of the hill country is still practised, and cocksfoot remains as a dominant there; and the more the area is spelled and the less it is grazed the purer the dominance of cocksfoot becomes (Figs. 67 and 68). The entire spelling of hill country affords cocksfoot the two essentials for its proper development: (1) By the ever-increasing decaying leafage the fertility of the soil remains high, and (2) the growing top creates the necessary shady conditions for the crown of the plant.

Of the general grazed country, the gullies, the richer slopes, the foothills, and the camping-places all have their quota of cocksfoot, associated with rye-grass, white clover, crested dogstail, and Poa pratensis. Where rye-grass is luxuriant and the pasture is kept reasonably short, cocksfoot is subjected to second or third place in the sward. Heavy grazing and much treading is a deterrent to cocksfoot-development, whereas they favour rye-grass very markedly, so that under these conditions cocksfoot may be found occupying but a small place only as a herbage-producer in the pasture, rye-grass easily being the dominant. A condition under which cocksfoot on rich soils does gain the upper hand of rye-grass is when the pasture is allowed to get away rank, so that the taller growth of the cocksfoot actually smothers out the rye-grass. Cocksfoot is essentially a top grass, a shade-endurer, and a shade-demander; rye-grass is a bottom grass, and will not tolerate dense shade. Cocksfoot associates quite well with white clover, but the same precautions must be observed as with rye-grass. Strong-growing cocksfoot allowed to overdevelop will smother out white clover. This is true, practically speaking, of all pasture species associated with cocksfoot—paspalum being an exception. The heavy top growth of cocksfoot, its tendency to form large outspreading tussocks, and its rather unpalatable herbage when it does get away, tend to make for a pure cocksfoot sward rather than for a well-balanced mixed pasture.

The light-and-shade factor plays a most important part with cocksfoot. Grazed too closely, the crown, from whence the new roots arise, becomes exposed to drying winds and to the heat of the sun, and too much light is allowed access to it. If the pasture is spelled the crowns are shaded, and the cocksfoot seems to take on new life. If allowed to grow rank the dense shade created kills out all the associate species, and the pasture becomes a pure cocksfoot association.

FIG. 64. COCKSFOOT AS DOMINANT ON PRIMARY BURN.

When the fertility of the bush-burn has become too low for rye-grass to flourish strongly cocksfoot comes to the fore. Dominance of cocksfoot on bush-burns, however, may be brought about through prolonged spelling of the area.

FIG. 65. GOOD EXAMPLE OF COCKSFOOT-MAINTENANCE ON A GRAZED AREA, NORTH AUCKLAND.

Owing to the heart not being eaten out of the grass through close and continuous grazing, coupled with a moderately fertile soil, cocksfoot bids fair to hold indefinitely on this area.

[*Photos by E. Bruce Levy.*

It will thus be seen that management has a big influence—apart from soil conditions—in deciding whether the pasture is to become dominated by cocksfoot (Fig. 69), whether there is to be a mixed pasture with cocksfoot as an associate species (Fig. 70), or whether cocksfoot will dwindle and die out from the area altogether (Fig. 66). On the sunny slopes of the hillsides it is more difficult to hold cocksfoot than on the shady slopes, and the reasons for this, again, are related to the shade-requirement of the cocksfoot itself. Stock are generally drawn to the sunny slopes because of the more pleasant living-conditions. These parts are then grazed closer than the shady slopes, which increases the amount of light reaching the crown of the plant. On the shady

FIG. 66. CLOSE, CONTINUOUS GRAZING COMPARED WITH ROTATIONAL GRAZING.

Hill-country pasture sown about twenty-five years ago. On left, scarcely a sign of cocksfoot under pernicious system of close and continuous grazing. On right (through fence), cocksfoot dominant under rotational grazing.

[*Photo by E. Bruce Levy.*

slopes stocking is not so constant nor so heavy; consequently the cocksfoot is allowed to get away, and that intensifies shade to the crown of the plant.

With a plant such as cocksfoot on the hill country, therefore, it will be seen that great possibilities, both for good and for ill, present themselves. In the first two or three years after the sowing of the primary burn cocksfoot may become a pure association. It may then be allowed to become tussocky and overdevelop to the detriment of the associate bottom grasses and clovers. Then, when cleaned up by cattle and further eaten out by sheep, the tussocks are greatly reduced in size, and a bare, open pasture invariably results. White clover may spread rapidly through such a cleaned-up and open pasture—provided

FIG. 67. COCKSFOOT AT AKAROA, SHOWING PURE DOMINANCE UNDER COMPLETE SPELLING AND SEEDING PRACTICE.

[*Photo by W. D. Reid.*

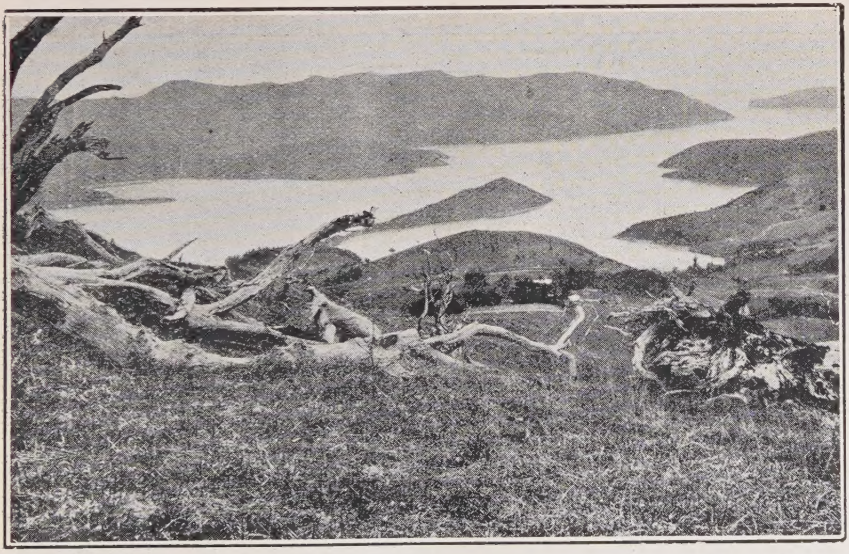

FIG. 68. COCKSFOOT AT AKAROA, SHOWING DOMINANCE OF COCKSFOOT UNDER SPELLING FOR SEED-PRODUCTION COUPLED WITH WINTER GRAZING.

White clover and Yorkshire fog often become subdominant in cocksfoot areas where winter grazing is adopted.

[*Photo by E. Bruce Levy.*

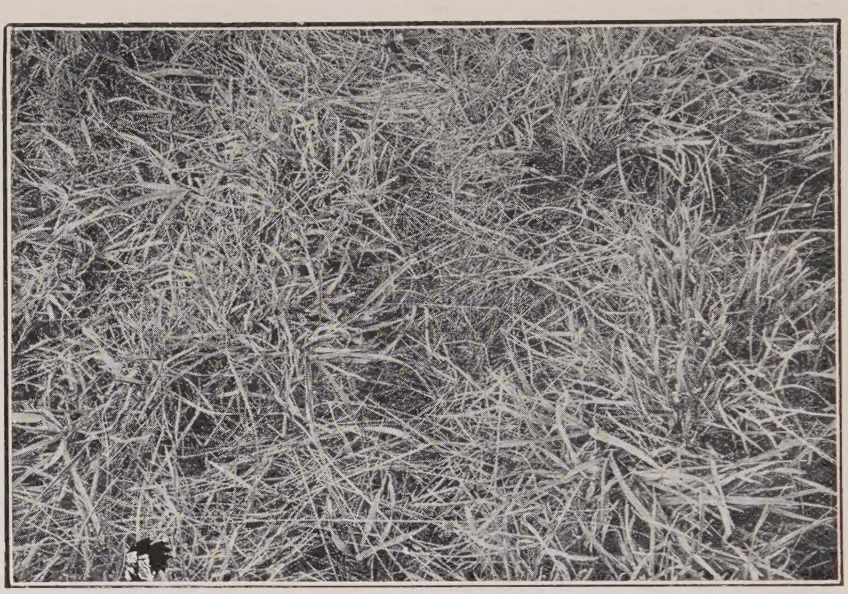

FIG. 69. COCKSFOOT THAT HAS OVERDEVELOPED AND HAS BEEN CLEANED UP SUBSEQUENTLY BY CATTLE.

Note the big tussocks of cocksfoot and absence of associate species, which have been killed out by the cocksfoot smother.

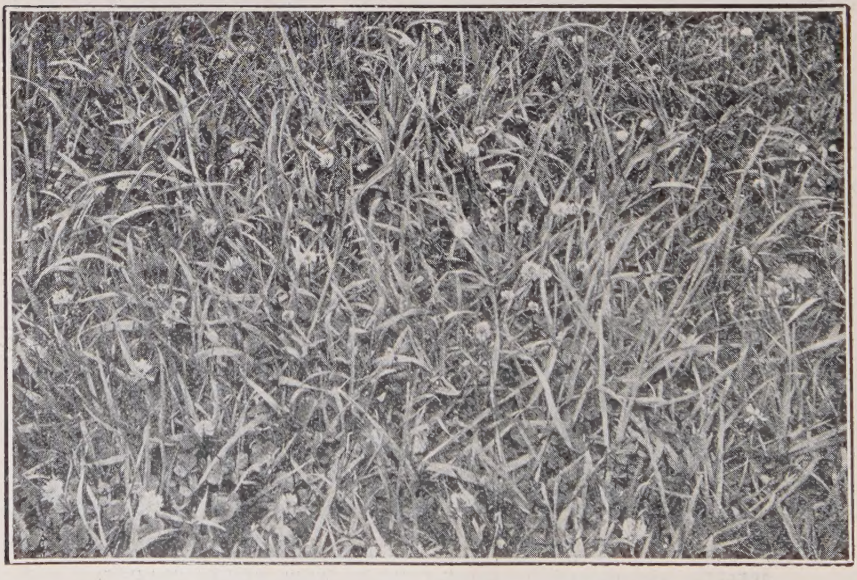

FIG. 70. COCKSFOOT AS A DOMINANT KEPT WELL IN HAND BY JUDICIOUS GRAZING.

Note the beautiful association of white clover and a certain amount of rye-grass with the cocksfoot.

[*Photos by E. Bruce Levy.*

the soil-fertility still remains high—but more frequently there results a numerous invasion of catsear, hawkweed, rib-grass, field-daisy, self-heal, cudweed, ragwort, piripiri, &c. (Fig. 71).

Cocksfoot will persist and thrive on soils that are not quite good enough for rye-grass, and on soils that are inclined to dry out somewhat in the summer it is found that cocksfoot usually gains the mastery over rye-grass. Cocksfoot will not thrive well on poor soils, and never on poor soils does it form a complete cover under grazed conditions. While the fertility of the bush-burn is high cocksfoot persists and grows strongly, but so soon as a reduction in fertility takes place the foliage loses its dark-green, healthy appearance, becoming yellow and stunted, and presenting quite an unpalatable herbage (Fig. 72). The tussock plant dwindles in size, few tillers are formed, and a decided opening-up of the pasture takes place (Fig. 73). Deterioration of the hill country to inferior grasses or weeds or secondary growth is bound to take place at this juncture.

Cocksfoot is generally regarded as a deep-rooting grass, and there is no doubt that under good conditions the new roots formed at the crown fairly rapidly penetrate into the soil and serve to anchor the plant firmly. On the other hand, when it becomes weakly, and when the crown becomes exposed to drying wind and sun so that scarcely any new roots are formed, the plant, owing to the dying and decay of the old root-system, becomes most insecurely held in the soil, and is readily pulled or knocked out by stock (Fig. 74). The binding of cocksfoot by some associate grass, such as Poa pratensis, on loose friable hill-country soils lessens to some extent the pulling-out of the cocksfoot-plants; but by far and away the better practice is to keep the cocksfoot-plants strong and healthy by manuring, and to allow a certain amount of get-away of the foliage so that the crown is shaded, particularly in the early spring and after the first rains of autumn.

POSITION OF COCKSFOOT SUMMED UP.

Summing up the position of cocksfoot on hill country in general, it must be admitted that this grass has not stood the test of present-day farming methods. Cocksfoot has been sown in varying amounts on virtually every acre of hill country that has been felled and grassed. It has more or less failed on all the country that has reverted to secondary growth; on all the country that has run predominately to brown-top, Danthonia pilosa, paspalum, or ratstail; and on all the country where herb-like weeds such as catsear, hawkweed, rib-grass, cudweed, piripiri, &c., have gained the upper hand (Fig. 75). This seems rather a sweeping statement to make, but who can gainsay the predominance of one or more of these grasses or weeds on vast areas of hill country in New Zealand? Had due regard to the growth-form of the cocksfoot-plant been taken, and had rotational grazing been practised instead of close and continuous grazing, we might now have been able to claim for cocksfoot a very much greater place on the hill country of New Zealand.

It is not too late, however, to make amends. Innumerable plants of cocksfoot still persist as stunted vestiges among the weeds and inferior grasses. The writer ventures to say that spelling such country

for a whole growing season, increasing its fertility by top-dressing or other means, and thereafter adopting rotational grazing would greatly improve the outlook for cocksfoot on most of the hill country. Cocksfoot is a high-yielding plant ; a permanent high-yielding plant is a great drain on any soil ; the soil can only yield up its natural endowment, and when this is exhausted starvation conditions prevail. Cocksfoot adapts itself to the infertile soil conditions, dwindling in size to a mere vestige, to persist as such until the farmer wakes up to the deplorably barren state his grassland soils have reached.

FIG. 71. COCKSFOOT AREA AT AKAROA WHERE COCKSFOOT WAS AT ONE TIME CUT FOR SEED, NOW GRAZED CONTINUOUSLY FOR DAIRYING.

Cocksfoot has considerably declined, and the open sward has become invaded by rib-grass, field-daisy, catsear, &c. This is an intermediate stage on Akaroa country between the pure cocksfoot phase and the danthonia-dominant phase, which latter comes later under close and continuous grazing for ten years or more.

[*Photo by E. Bruce Levy.*

POSSIBILITIES OF PLANT-BREEDING.

The plant-breeder may be able by selection to give us more permanent strains of cocksfoot, and the farmer, by sowing seed of approved strains, may be able to ward off to some extent the disappearance of this grass from our hill lands. Professor R. G. Stapledon's* work at the Welsh Plant-breeding Station, Aberystwyth, is full of promise in this respect. Strong-tillering forms, with the crown as deep into the ground as possible, have a decided advantage over weak-tillering forms that are inclined to run up to top rather than to good

* The writer has recently had the pleasure of conducting Professor Stapledon over the major grassland types in New Zealand, and it is felt that much good will be derived from his visit to the Dominion, by the exchange of views on grassland problems.

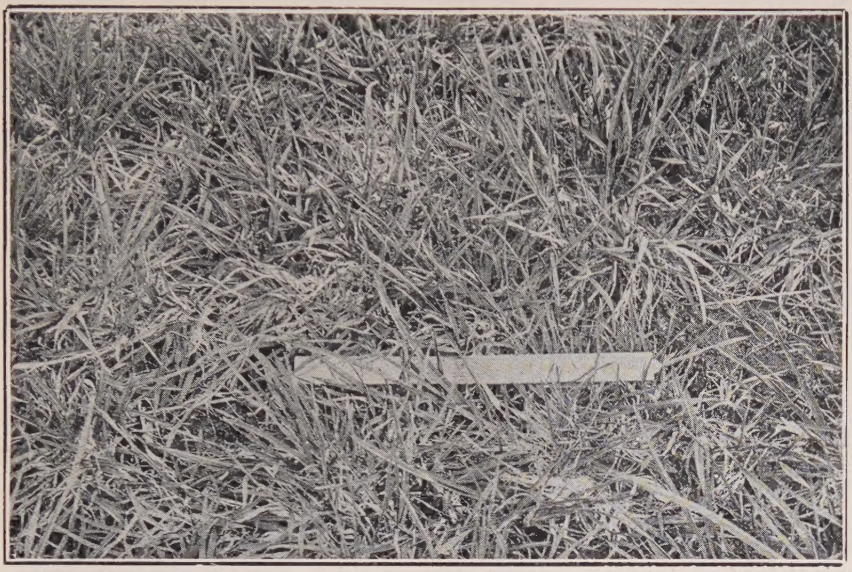

FIG. 72. COCKSFOOT BEGINNING TO DWINDLE AS THE FERTILITY OF THE SOIL BECOMES REDUCED.

Herbage yellow and stunted, and quite unpalatable to stock.

FIG. 73. COCKSFOOT UNDER LOW SOIL FERTILITY.

The plants have dwindled considerably, and the pasture is now open to invasion by inferior grasses, weeds, or secondary growth.

[*Photos by E. Bruce Levy.*

bottom growth. Akaroa cocksfoot, according to Professor Stapledon, approaches nearer to the ideal form of the plant than does Danish cocksfoot. The former is more inclined to tiller out strongly with widely divergent shoots, while the latter is less inclined to tiller, and the shoots are more inclined to become erect. The ordinary form of cocksfoot, however, will have to be modified to a large extent by the breeder before the plant can stand close and continuous grazing by sheep.

Again, the writer is of the opinion that no amount of plant-breeding will produce a cocksfoot that will grow strongly and be of permanent high production on poor soils. High production is possible only under adequate feeding of the plant, and the skill of the plant-breeder in producing high-production strains is of avail only when accompanied by proper manuring of the strains selected. With an annual crop the ground can be greatly improved by fallowing and liberal cultivation, and the manure applied at the time of sowing can easily be augmented to cater for any increased demand the high-producing strain makes on the soil. But in the case of plants permanently occupying the ground, if we put on to that soil higher-producing strains and fail to make good the annual loss of plant-food taken by such plants it simply means that the higher producer will exhaust the supply of plant-food in that soil sooner than would a lower-production strain. Therefore permanency in cocksfoot, or in any other plant, on soils where the outgo of plant-food cannot be made good must be achieved by the plant-breeder along the lines of selecting low-production rather than high-production strains. On the other hand, where plant-food is plentiful, or where it can be augmented at the will of the farmer, there are immense possibilities for the plant-breeder. In the matter of breeding of pasture-plants—our mainstay of production—this country is decidedly weak.

COCKSFOOT UNDER SHADY SECONDARY-GROWTH CONDITIONS.

As already mentioned, cocksfoot is a shade-endurer, and it persists for many years in the shade of the lighter types of secondary growth. It is, however, of little value in the control of secondary growth, owing to the fact that it will not endure a severe fire. With a good deal of cocksfoot among secondary growth crushing out with cattle is generally to be preferred to burning, but where the growth is dense the cocksfoot has become so weak that burning or crushing usually kills the old weakened plants. When in dense shade the crown of cocksfoot rises well above the level of the soil, so that even if the plant escapes death by burning it is not long before it is pulled or knocked out of the ground by stock.

COCKSFOOT IN PRIMARY AND SECONDARY BURNS.

From what has been said it will be seen that cocksfoot, like rye-grass, has its limits and shortcomings on hill country in New Zealand, and particularly so under the present system of close and continuous grazing by sheep. On new primary burns, however, there certainly is a place for cocksfoot. It works admirably as a follower to perennial rye-grass when the high fertility of the burn begins to lessen. The plant is a fairly rapid establisher from seed, and the seed is not

FIG. 74. COCKSFOOT CLOSELY GRAZED TO THE CROWN.

New roots cannot develop from these exposed crowns, and as soon as the old root-system dies away the plant becomes most insecurely anchored in the soil. Under these conditions the plants are easily pulled out by stock.

FIG. 75. A STRIKING EXAMPLE OF THE FAILURE OF COCKSFOOT.

When cocksfoot fails, secondary growths or inferior grasses or weeds, as shown in photo, are bound to put in an appearance. The coming-in of these is a certain indication that cocksfoot is failing.

Photos by E. Bruce Levy.

unreasonably expensive. As with rye-grass, however, complete reliance should not be placed on cocksfoot. These two species in themselves are not sufficient to permanently and successfully grass the hill-slopes, and the poorer the country the less can we rely on rye-grass and cocksfoot. On average slopes 8 lb. to 10 lb. of cocksfoot in the mixture for the primary burn is sufficient.

With regard to the secondary burn, the inclusion of cocksfoot in the mixture seems almost a waste of good seed and money. Where tall dense bracken, wineberry, fuchsia, or strong-growing manuka is being cleared, burnt, and sown, or where top-dressing of the secondary burn with artificial manures is possible, then it may well repay the farmer to include 3 lb. to 4 lb. of cocksfoot-seed per acre in the mixture sown. When dealing, however, with stunted bracken, short manuka, hard fern, &c., the inclusion of cocksfoot may certainly be regarded as waste.

In the Department's experiments at Whangamomona cocksfoot has proved one of the most expensive of plants to establish. In the first year it cost ten times as much to cover the ground with cocksfoot herbage as it did with rye-grass, twelve times as much as with crested dogstail, and about sixteen times as much as with brown-top. In analyses made so far this year on the same plots—two years after sowing—the position of cocksfoot in the plots sown has become worse rather than better. From these results, therefore, it seems imperative that the farmer should rely scarcely at all on cocksfoot for sowing his secondary burns. If he considers the country he is cleaning up is above the average, then the inclusion of from 3 lb. to 4 lb. of cocksfoot may be justified, but on no consideration should money be spent on cocksfoot unless he can afford to buy this seed in addition to the full quota of certain of the hardier grasses and clovers to be mentioned in a later article.

CONCLUSION.

In conclusion, cocksfoot, together with perennial rye-grass, has sadly declined on hill country, and for this decline two major factors are largely responsible: (1) The depletion of fertility; (2) the pernicious system of close and continuous grazing by sheep. In addition to a plentiful supply of plant-food cocksfoot must have shade for its crown at certain periods of the year. To the writer there does seem the possibility of a great improvement as regards cocksfoot—apart altogether from top-dressing—if only farmers could adopt a rotational system of grazing rather than the close and continuous system so common over most of the hill country.

(Series to be continued.)

Production of Casein.—The annual report of the Dairy Division for 1925–26 states: "The quality of casein manufactured in the Dominion is now of a high standard, a noticeable improvement in the green curd being evidenced. Manufacturers are now producing a high-grade rennet casein containing a minimum quantity of butterfat. This casein has a high marketable value. Production has not been so high, this being to some extent attributable to a number of dairy companies reverting to cheese and home separation during the year. The quantities graded for export amounted to 1,126 tons lactic and 624 tons rennet casein, a total of 1,750 tons."

CHRONIC HÆMATURIA AFFECTING CATTLE.

NOTES ON CASES IN THE SOUTH ISLAND WEST COAST DISTRICT.

J. KERRIGAN, M.R.C.V.S., District Superintendent, Department of Agriculture, Christchurch.

CHRONIC hæmaturia, a disease affecting cattle—especially dairy cows—is characterized by intermittent periods during which the urine discharged contains varying quantities of blood. The disease is usually of comparatively long duration. During the past year I have met with two typical cases and have heard of several others. So far as can be ascertained the disease has not been reported previously in New Zealand.

Chronic hæmaturia was noted in France as far back as 1864, and in other Continental countries at later dates. In British Columbia it evidently caused serious losses in certain districts, and the trouble was carefully studied by Bowhill and Seymour Hadwen between the years 1907 and 1912. It has also been noted in Africa and other countries. Only within comparatively recent years has the disease been observed in Britain. Late in 1914 Wallis Hoare stated that, so far as he was aware, it had not been noted in the British Isles. J. F. Craig, of Dublin Veterinary College, who in conjunction with D. Kehoe studied this trouble within recent years in Ireland, states: "Our first suspicion of the presence of chronic hæmaturia in this country (Ireland) was aroused about 1917, but it was not until 1922 that an opportunity arose to investigate it in two cows, and later in a third one, and to show that it is identical in all its details to that noted in other countries." He further remarks: "One may be allowed, however, to state at once that there is every reason to believe that this condition is not of recent introduction into the country, but has for a long time remained unrecognized and has frequently been mistaken for redwater."

LOCAL CASES.

In the various districts in New Zealand in which I have been located or have travelled I have now and again been asked to advise regarding the treatment of a cow or cows affected with redwater. On several occasions during the past seven or eight years similar requests came from the Murchison and Inangahua districts, but no opportunity occurred of examining an affected animal. When lecturing at the Department's winter farm school on the West Coast during June of last year I was again asked to advise regarding the treatment for so-called redwater. However, on discussing the matter with three of the settlers I strongly suspected that their cows were affected with chronic hæmaturia and not redwater. I advised the settlers accordingly, and asked them to keep in touch with the Stock Inspector for the district and with myself, so that if an opportunity occurred the trouble might be investigated.

In December last information was received that there was an opportunity of seeing two or more affected cows. Mr. P. McGregor,

Departmental Veterinarian, visited the district, and, without knowing that I had strong suspicions of chronic hæmaturia as affecting cows in that area, his report strengthened my suspicions. In fact, in his report he gave the following description of some of the typical symptoms: "Firstly, the animals were seen to pass bloody urine. No condition was lost, nor was the milk-supply diminished in the first stages. The cows generally became affected at calving-time in September, and except in isolated cases the urine cleared during the summer—the animal having apparently recovered. In the following spring at calving-time the urine again became bloody, and in this case it became gradually thicker, until there was passed with the urine a stringy, leathery substance in the form of clots. Shortly after this condition began the animal rapidly lost condition and died. In some cases the animal would apparently again recover during the second summer, only to become again affected the following spring and die." Mr. McGregor did not make a *post mortem* examination of any of the affected cows, as those he examined were only slightly affected, and he considered it advisable to await further developments.

In March of this year Mr. C. S. Neville, Inspector of Stock, while in the district on other matters, had an opportunity of making a post-mortem on an affected cow, and he sent the bladder to the Wallaceville Laboratory. This exhibited typical symptoms said to be found present in cases of chronic hæmaturia. In April, in company with Mr. Neville, I made a post-mortem on an affected cow, and we saw another one only slightly affected. Although the cow on which we made the post-mortem was not in the advanced stages of the disease, the changes found present were typical of chronic hæmaturia, and crystals of calcium oxalate were found present in the urine.

The area in which the trouble occurs is somewhat isolated and difficult to keep in close touch with, consequently only a limited number of cases have come under my notice, and I am indebted to former investigators for some of the following information.

The animals affected are generally matured cows (five years old and over), but occasionally younger animals have been noted as exhibiting typical symptoms. It is stated that occasionally a bull has died of the trouble, and Mr. Neville informs me that from inquiries he has learned that a certain number of working-bullocks in the early days in the Murchison district were similarly affected and died.

The area in which the disease appears lies roughly between Reefton and Murchison, and is (or had been prior to clearing) covered with what the settlers call brown, black, silver, or red birch—correctly beech (*Nothofagus*) species. When the bush is felled the land runs very rapidly into bracken fern. It will be understood from this that in general the land has not been improved to any extent by the addition of artificial manures, &c.

One or more cows may be affected on the farm at the same time, but, of course, this depends to some extent on the number kept. One farmer informed me that during the past five years his loss out of a herd of twenty-six cows had been thirteen, equal to 10 per cent. The cows are generally turned out into the bush when dry, and are brought in again in the spring.

SYMPTOMS.

Symptoms are as follows: Greater or less discoloration of the urine—generally in spring when the animal is brought in. The colour may be brown or red, or blood-clots may be passed, and the animal may occasionally strain. Apart from this, it appears to be in good health and otherwise normal. It may remain in this condition for a varying period, but in general as the flush of grass comes on in summer the animal apparently recovers. In the autumn the urine discharged may again be mixed with blood, or the trouble may not appear again until the following spring, and if the urine is badly affected it may contain so much blood that it sets to a reddish jelly soon after being passed. The affected animal may succumb to the first attack, or it may have several attacks. I have heard of one cow that has shown this discoloration of urine on different occasions for four years.

As a result of the loss of blood the animal ultimately loses condition, generally exhibits dropsical swellings under the lower jaw or in the dewlap, and diarrhœa may appear in the last stages. It is stated that excitement exaggerates the symptoms, and that once the animal becomes affected it rarely actually recovers, also that the symptoms become more marked with each attack. Some cows apparently resist the disease, as one owner informed me that he had cows that had been respectively eight, ten, and thirteen years on the affected area and had never shown any symptoms of the trouble.

Under *post mortem* examination the bladder contains a varying quantity of urine mixed with blood, and generally crystals of calcium oxalate can be found in the urine. The bladder is the only organ showing any important lesions. The mucous membrane lining this organ is rough, and contains a number of small red spots, patches, and streaks; in the one I examined at two places there appeared also to be some granulation tissue. It is stated by investigators that in advanced cases growths of a fibro-papillomatous nature are found present in the bladder.

CAUSES AND TREATMENT.

A number of causes have been suggested by investigators. It has been suggested that the disease is caused by some poisonous plant, but the actual plant so far has not been determined. Others consider the trouble may be microbic in origin or that it may be caused by parasites, but investigations so far have not supported these suggestions. Hadwen apparently demonstrated that all the appearances presented in the disease could be produced by large doses of oxalic acid given over an extended period of two years. It is therefore not improbable that the disease may result from oxalic-acid contents of the herbage on which the cattle are allowed to graze for a long time, or to some toxic substances in the pasture.

It has been stated that when 2 to 4 drachms of calcium lactate have been given daily for a week some improvement has been noted in the animal. Experience has evidently shown in France, British Columbia, and elsewhere that following agricultural improvements, such as better drainage and top-dressing with lime and manures, in the affected areas the disease tends to disappear.

FARM ECONOMICS.

WORK OF NEW BRANCH OF FIELDS DIVISION.

E. J. FAWCETT, M.A. (Cantab.), Fields Division, Department of Agriculture, Wellington.

A PROMINENT agricultural educationist of the United States, Dr. Liberty H. Bailey, once said that the requirements of a good farmer are at least four. They are these abilities: (1) To make a full and comfortable living from the land; (2) to rear a family comfortably and well; (3) to be of good service to the community; and (4) to leave the farm more productive than he found it.

Until comparatively recently agricultural educationists have been mainly concerned with the study and teaching of pure and applied sciences relative to farming, the business aspect of the industry being almost neglected. Undoubtedly the work of agricultural chemists, botanists, &c., has led to the collection of a great amount of information which has been instrumental in increasing production. Yet there are many farm operations possible which are not economically sound under every condition. The law of diminishing returns—which in effect means that after a certain point is reached subsequent applications of labour and capital will not raise production proportionately—comes into operation in agriculture perhaps more quickly than in any other industry. It was the realization of this fact which led to the rapid growth of the study of business and general management organization of the industry, first in America, then on the Continent of Europe, and next, in 1913, in Great Britain.

There are three factors controlling production—namely, land, labour, and capital. It is the business of the agricultural economist to study and investigate these factors, for it depends on their relationship to each other—the conditions of their supply, maintenance, and manipulation—whether the industry is profitable or not.

New Zealand is rapidly approaching the stage in its rural existence where it becomes essential that a study of these conditions as they affect production should be made if output is to be increased on lines calculated to better the farmer and increase the prosperity of the country. In the past the greater part of our agricultural instruction has been based on experience and observation, the business factors being more or less ignored. If the agricultural education and instruction of the future are to be sound they must be based on sound economic lines, and until a careful and systematic study of the basic factors governing local production is made any instruction given must be lacking in its first essentials.

Realizing the importance of such data, the Department of Agriculture has recently added to the activities of its Fields Division a branch of farm economics, with the object of developing investigation on these lines. As in the past the great source of our information has been the farmer himself, so in this investigation the farmer must be looked to to supply the necessary facts. One hears constantly such statements as "land is too dear"; "rates and taxes are too high"; "labour is prohibitive"; "money is unprocurable at a reasonable

rate of interest"; "I cannot afford to top-dress or subdivide"; and many others of a similar nature. Before any reform can be advocated, or any practice emphatically declared profitable or otherwise, it is necessary to know the position of the farming industry as it at present exists, and without the co-operation of the farmer very little can be done. The information required by the Fields Division must of necessity be of a private nature, but we feel that there are sufficient broad-minded men in New Zealand who will be only too willing to supply it, appreciating, as they must, its importance in our future development.

There are two methods used by investigators in Great Britain, the Continent of Europe, and America: (1) A system of cost accounting on individual farms; (2) an individual farm survey with estimation of expenditure and receipts. In both cases a study of management and general farming conditions must also be made.

It is desirable that a certain number of picked farms in each district be put under a very accurate system of costing, and that a large number be subjected to a survey so that they may be checked against the standard. In order to indicate to readers the type of information desired in the farm-survey investigation the items of the questionnaire to be used by the Fields Division are here reproduced as follows:—

Name and address:

County:

Data for year ending

1. Size of farm:
2. Tenure:
3. Description of farm:
4. Number of paddocks:
5. Estimated mileage of fencing, and cost:
6. Size of paddocks:
7. Cover of paddocks:
8. History of paddocks for four previous years:
9. Stock: Number and breed as at 31st March approximately:—
   Sheep—Ewes:
   Wethers:
   Hoggets:
   Others:
   Cattle—Dairy cows, eighteen months or over:
   Dairy heifers, under eighteen months:
   Hill cattle, eighteen months or over:
   Hill cattle, under eighteen months:
   Horses:
   Pigs:
10. Estimated value of farm equipment and buildings (not dwelling house): £
11. Type of farming practised:
12. Date of taking up farm:
13. Total number of family on farm—
   (*a.*) Under sixteen years: Male , female
   (*b.*) Over sixteen years: Male , female
   (*c.*) Helping on farm:
14. Personal capital put in on taking over farm: £
15. Mortgages: £
16. Interest on mortgages: £
17. Price per acre paid on taking up farm: £
18. Amount paid off since: £
19. Overdraft at bank: £
    Overdraft interest: £

20. Rent : £
21. Rates : £
22. Taxes : £
23. Gross takings for year ending : £
24. Gross expenses : £
25. Estimate of household expenses : £
26. Wages : £
27. State if labour is found in food :
28. Labour :—
    (*a.*) Number employed :
    (*b.*) Total weeks labour employed :
    (*c.*) How employed :
29. Main items of revenue :—
    Wool : £
    Meat for export—
        Sheep : £
        Cattle : £
    Fat stock for local market—
        Sheep : £
        Cattle : £
    Store sheep : £
    Store cattle : £
    Dairy cows : £
    Butterfat or milk : £
    Wheat : £
    Oats : £
    Chaff : £
    Other items :
30. Main items of expenditure not enumerated elsewhere :—
    Purchase of sheep : £
    Purchase of cattle : £
    Purchase of manures : £
    Other items :
31. Government valuation of farm : £

Short description of system of farm-management :

Any outstanding features :

Following are a number of economic problems which are urgently in need of solving. It will be quite readily seen that with a mass of data of the foregoing nature, collected from a wide range of farms, many of the urgent questions confronting the agricultural industry could be answered.

(1.) Farms arrange themselves in groups, each farm within that group being controlled by a similar combination of factors. Some show a profit, whilst others are worked at a loss. To what extent is it possible to alter the management of the low-producing farms so that they may be put on a sound basis?

(2.) In what proportions should land, labour, and capital be combined under different circumstances, such as nature of farming and locality, to give the highest net returns? In other words, what capital should a farmer possess in order to undertake, with a reasonable chance of success, a farm of any given size in any locality?

(3.) From what area of land under different types of farming can a man reasonably expect to make a management wage sufficiently high to enable him to provide for his family in comfort and give of his best to the State?

(4.) What is the crippling factor on many of our farms at the present day? Is it the high price of the land, high rates and taxes,

or over-capitalization in plant and improvements; or is it faulty management?

(5.) To what extent can such operations as subdivision, pasture top-dressing, provision of supplementary crops, and culling and improvement of stock be carried on economically?

(6.) What is the earning-value of land under average management skill on different types of soil in different localities under average marketing conditions?

These are some of the features which an investigation into farm management and costs would enable us to answer. It has been found in other countries that the greatest saving can be effected by rectifying farming conditions first. When the production end of the business has been placed on a sound footing, then attention can be given to other important questions such as exist between the producer and the ultimate consumer.

It is with this object in view that the Department has instituted its economic research branch. The aim is to help the farmer in every way, but to enable this to be done the farmer must also help the Department. By hearty co-operation we believe it possible to equip the farmer with such knowledge that he will be able to make a better and more comfortable living from the land, to rear his family in greater comfort, to be of better service to the community, and to leave his farm more productive than it is at present. Such a study as here outlined, in conjunction with the scientific study of other problems confronting the farming industry, is calculated to promote individual prosperity and to increase national wealth.

The Department appeals to farmers and others to assist in this undertaking. An assurance is given that information supplied will be treated as strictly confidential, and that subsequent publication of findings will be made in such a way that the identity of the individual will be completely obliterated. The writer of this article will be glad to receive inquiries from any farmer who may be interested in the work and who is willing to co-operate.

INOCULATION AGAINST BLACKLEG DISEASE.

In his annual report for 1925–26 the Director of the Live-stock Division states:—

Blackleg is still confined to the Taranaki District and to a portion of the Auckland Province. Inoculation of calves in the latter district is only carried out in cases where the disease has been confirmed, but in Taranaki the practice has been to vaccinate independently of whether outbreaks have been reported. The number of calves vaccinated during the year in Taranaki was 32,389, being an increase of 3,128 on the previous year. In remarking on the matter the District Superintendent, Wellington, makes the following comment, which I commend for consideration, as from the experience gained of the result of a similar policy in the Auckland District I am satisfied it is in the best interests of all concerned: "I think the time has arrived when a relaxation in the regulations dealing with this disease could very well be introduced in Taranaki, on similar lines to the procedure adopted in the Auckland District. The number of actual deaths reported as due to blackleg is very small compared with the volume of work entailed in general vaccination. No case of blackleg has occurred in the Hawera district for over three years."

ACACIA GALL-FUNGUS.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

A SERIOUS disease of wattle, *Acacia decurrens*, has become general throughout New Zealand in recent years, and so many inquiries concerning it have been made that this article is written to supply information as to its cause and remedial treatment.

The disease is noticeable on account of the conspicuous, dusty-brown galls present on the stems, branches, and pods. These may

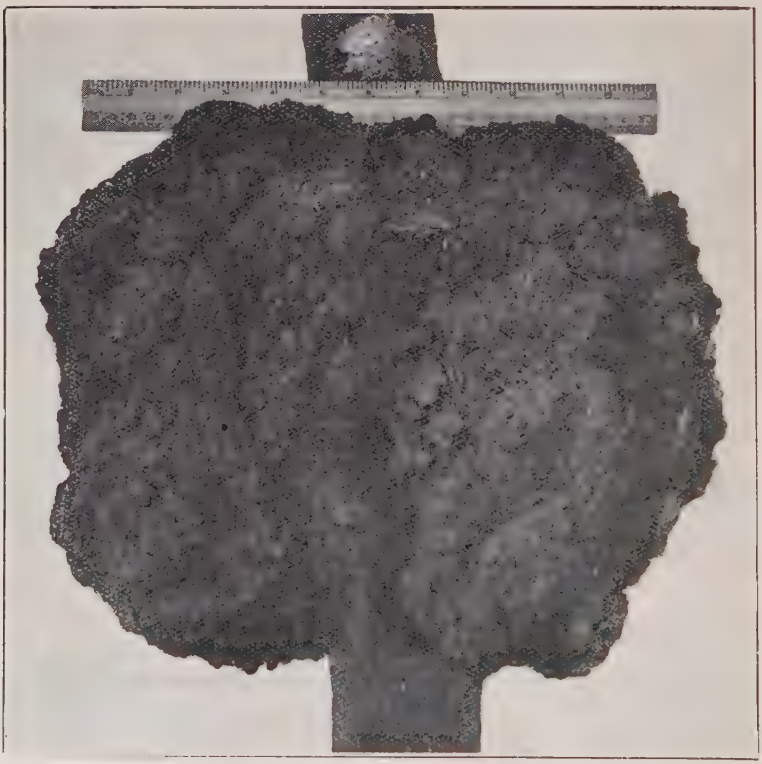

FIG. 1. GALL ON ACACIA-STEM, EXCEEDING 1 FT. IN DIAMETER.
[*Photo by H. Drake.*

remain for several seasons and, owing to their structure, seriously impair the work of the conduction-vessels of the branches; consequently the portions beyond the galls make little growth and produce few leaves. The tree thus suffers from partial starvation and eventually dies. In cases of severe infection trees may be killed outright in a season or so. A less noticeable feature of the disease is the production on leaves, petioles, and laterals of small, purple, blister-like spore-pustules.

The galls are commonly the size of a walnut, but may attain to a diameter of 1 ft. or more (Fig. 1). When sectioned they are seen usually to be tunnelled with the borings of insect larvæ, and this has led to the belief that the galls are due to insects. Such is not the case, however, for they are caused by one of the rust fungi, *Uromycladium notabile* McAlp., the spore masses of which cover the exterior of the galls, giving them a dusty-brown appearance. The insects are secondary, living at the expense of the gall, and are in no way connected with their formation.

Spores (uredospores) are produced on the exterior of the galls, and these are detached and carried by the wind to other plants in the vicinity, where, should conditions prove favourable, they may germinate and cause further infection. In this manner the disease quickly spreads throughout the trees in a plantation. The mycelium of the fungus perennates in these galls, and produce each season over a period of years quantities of spores. Therefore, once a tree becomes infected it is a constant source of infection for other trees planted in the vicinity. As has been mentioned, spore-pustules are also produced on leaves, petioles, and laterals. These consist of a second type of spore (teleutospore), which germinate on reaching maturity (usually during the summer months) and produce basidiospores, also capable of infecting any host plant on which they may alight.

FIG. 2. GALL CAUSING DISTORTION OF STEM OF YEARLING ACACIA DECURRENS.

[*Photo by H. Drake.*

Little was known of this rust until 1905, when McAlpine (1) made an intensive study of this and other rusts attacking species of the genus *Acacia* in Australia. He found that it and several others confined to this host genus belonged to an undescribed genus of fungi which he named *Uromycladium*. McAlpine described seven species of *Uromycladium*, occurring in all on twenty-seven species of *Acacia*, and showed that the genus was essentially an Australian one.

The disease has been introduced into New Zealand on seedling plants, and has then been spread by means of infected plants throughout both Islands (Fig. 3).

FIG. 3. GALLS (INDICATED BY ARROWS) ON SIX-MONTHS-OLD ACACIA-SEEDLINGS.

It is by the use of such plants that the disease is disseminated.

[*Photo by H. Drake.*

The species discussed above, *Uromycladium notabile*, usually occurs on *Acacia decurrens*, but it is not confined to this host, having been frequently collected on *A. Bayleyana* and occasionally on *A. dealbata*; in Australia and Tasmania it has in addition been recorded by McAlpine as attacking *A. binervata*, *A. elata*, *A. notabilis*, and *A. pruinosa*.

A second gall-forming species, *Uromycladium Tepperianum* McAlp., has been found in Auckland to attack prickly-acacia, *A. armata*, producing thereon a gall similar to that formed by *Uromycladium notabile*. In Australia and Tasmania this latter species appears to be abundant, for McAlpine records it on the following nineteen species of acacia: *A. armata, A. diffusa, A. eriocladа, A. glaucoptera, A. hakeoides, A. implexa, A. juniperina, A. longifolia, A. melanoxylon, A. myrtifolia, A. pycnantha, A rigens, A. salicina, A. siculiformis, A. spinescens,*

FIG. 4. SHOWING EFFECT OF GALLS ON LATERALS.

On right: Primary infection; note torsion, and that terminal portion of lateral continues beyond gall.

On left: Old gall showing destruction of terminal leaf-bearing portion of lateral.

[*Photo by H. Drake.*

A. stricta, A. verniciflua, A. verticellata, and *A. vomeriformis.* This species is stated to have been found also in Java on *Albizzia montana* (4).

Of the five other species recorded for Australia by McAlpine, three—*Uromycladium Acaciæ, U. alpinum,* and *U. Robinsoni*—have been collected in New Zealand (2, 3); but as they do not produce galls, and consequently do little damage to the host plants, they are of minor economic import.

REMEDIAL TREATMENT.

Nothing can be done with a tree once it has become infected. It has been suggested that the galls be removed and the sources of infection thereby destroyed. But this is impracticable, for, as has been shown, a second form of spore is present on the leaves, petioles, and laterals, which would lead to further infection.

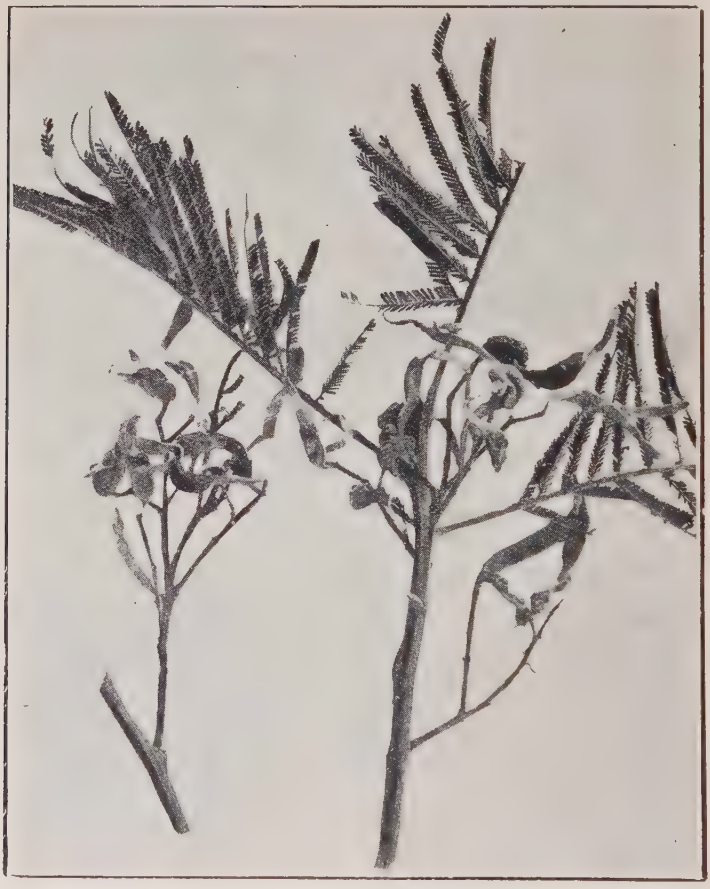

FIG. 5. POD-INFECTION.

The galls usually destroy the pods, so that it frequently becomes difficult to secure seed from severely infected trees.

[*Photo by H. Drake.*

Avoidance of infected plants used in planting is the only method at hand whereby infection may be obviated. For this purpose it is necessary to secure seed from trees free from the disease, and to sow it in an area removed from the vicinity of infected trees. The common nursery practice of sowing seed from infected trees in their vicinity should be avoided. It is through this means that the disease has

become so widely disseminated throughout New Zealand in recent years, for the seedling plants become infected in the nursery through spores wind-borne from neighbouring infected trees, and carry the disease with them wherever they may be planted.

The writer is indebted to Mr. T. Rodda, Manager of the Te Kauwhata Horticultural Station, for information concerning the incidence and behaviour of the acacia gall-fungus at Te Kauwhata, and for forwarding specimens; and to Mr. H. Drake, of this Laboratory, for the accompanying photographs taken therefrom.

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NAURU AND OCEAN ISLANDS PHOSPHATE.

The following is extracted from a statement on this subject in the annual report of the Director-General of Agriculture for 1925–26:—

"There are no harbours at the islands, the steamers during loading operations lying in the open roadstead anchored to special moorings which are in deeper water than perhaps any others in the world. Loading is carried out through the medium of lighters, hence shipping operations are governed almost entirely by weather conditions. For the first five years of the British Phosphate Commission's operations the weather interfered very little with loading operations, with the result that all orders from partner countries were promptly filled and surplus production disposed of to other countries at very profitable market rates. These conditions, which favoured a maximum output so necessary where heavy overhead charges are inevitable, were reflected in a gradually decreasing c.i.f. cost., with corresponding benefits to purchasers of the manufactured superphosphate. Unfortunately, very unfavourable weather conditions were experienced for a considerable portion of the year 1925–26, with the result that shipping operations were delayed, storage limits at the islands were reached, and it was impossible to supply from the islands all of the requirements of the partner countries. In order to furnish the manufacturers with raw material, and so ensure adequate supplies of superphosphate for consumers in the partner countries, the British Phosphate Commission, acting for the manufacturers, met the position by purchasing from the most favourable sources of supply (including Florida, U.S.A., and Morocco) the large quantities of phosphate rock needed to meet the deficiency. These purchases were, of course, at a greater cost than Nauru and Ocean Islands phosphate, but, in order to avoid fluctuations in the prices of superphosphate due to varying prices for the raw material, the Commission agreed to distribute the extra cost of the needed outside supplies by increasing by a small amount per ton the selling-price for the year commencing on the 1st July, 1926, and making the sales on terms convenient to the purchasers.

"Extensive improvements in the storage and shipping facilities at the islands are being arranged by the Commission with the object of reducing costs of production, increasing the output, and making possible speedier loading of vessels, and so utilizing to the utmost weather conditions favourable to the loading of ships. These works will take a number of years to effect, but when completed will enable the output to be greatly increased."

TREATMENT OF IRON-HUNGER IN STOCK.

THE PROPER USE OF IRON-AMMONIUM CITRATE.

B. C. ASTON, F.N.Z.Inst., Chemist to the Department of Agriculture.

THE use of double citrate of iron and ammonium in the prevention and cure of iron-hunger (bush sickness) has been so successful at Mamaku that many farmers on the sandy silt and coarser pumice lands have taken advantage of this Department's offer to supply the drug to *bona fide* farmers at cost price—3s. 3d. per pound—through the Stock Inspectors at Rotorua and Tauranga. So far as can be learnt, favourable results are being experienced by those who are trying the drug and who follow the instructions. It is important that the instructions should be followed as already given in the *Journal*. They are here repeated for general information:—

The dose for a cattle beast is 2 fluid ounces of a 6-per-cent. solution twice daily; 1 lb. of the crystals may be dissolved in 13½ pints of water to make this solution. The medicine may be sprinkled on hay or other fodder for ease of administration. For younger animals the dose should be proportionately reduced.

Some farmers have mistaken the directions to dissolve the drug in water and give 2 oz. of the solution, and have given 2 oz. of the solid scales. This is a serious mistake, and is likely to have injurious rather than beneficial results on the stock so treated.

It is convenient here to summarize the full authoritative method of coping with iron-hunger in stock. The following is the official recommendation for farming-lands of the volcanic soil province classified as sandy silts and gravelly sands of the Rotorua County (see map published in the issue of this *Journal* for June last):—

(1.) Farm more highly; get the plough in; compact the soil; grow plenty of winter feed; and save plenty of hay. Subdivide into smaller paddocks, and keep the pastures eaten short. Top-dress with phosphate—preferably containing iron or in conjunction with iron sulphate—as frequently as is the practice to top-dress in the Waikato. Treat the stock well, especially in the matter of water-supply.

(2.) Use molasses freely in the feeding, especially in rearing young stock. Regard molasses as a preventive, but not as a cure.

(3.) When an animal shows signs of going back in condition owing to iron-hunger, give iron-ammonium citrate as supplied by the Mamaku Demonstration Farm, and by the Stock Inspectors at Rotorua and Tauranga, at cost price to *bona fide* farmers.

(4.) Buy any stock required from districts remote from the affected pumice land, and under conditions which ensure that the animals are free from disease or parasitic infection. Lack of the mineral elements is known to predispose an animal to other diseases and ailments, which, when introduced on to a farm on sick country, run a rapid course in the stock.

PASTURE TOP-DRESSING AT TE KUMI.

FIFTH YEAR'S EXPERIMENTAL RESULTS.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

THE permanent-pasture plots at Te Kumi were not top-dressed in 1925. During the preceding four years the plots received annual dressings of phosphatic fertilizers at the rate of 3 cwt. per acre. On the unlimed areas, plots with dressings of superphosphate have been tried alongside plots receiving dressings of basic slag and others dressed with ground raw rock phosphate (Nauru-Ocean). On an adjoining area, which was limed at the beginning of the experiment five years ago, plots were dressed with superphosphate side by side with plots treated with ground rock phosphate.

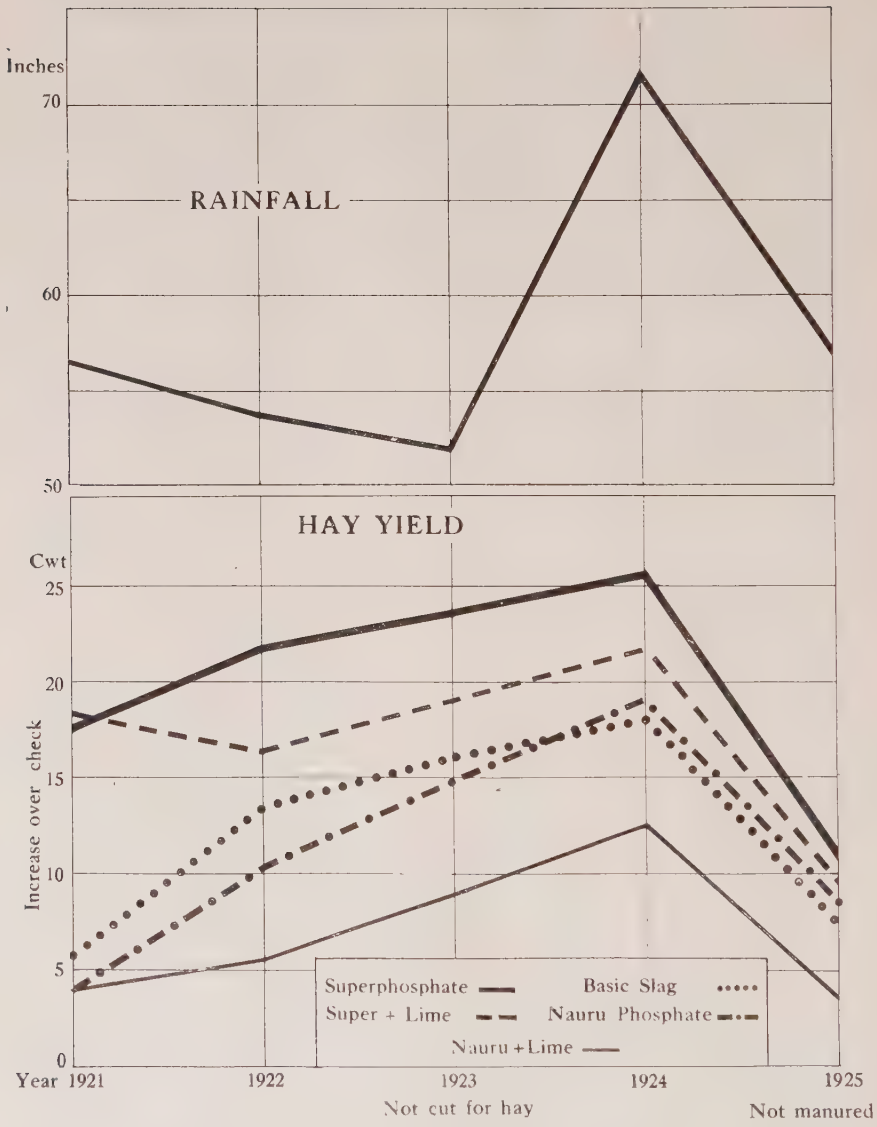
The object of omitting top-dressing last season was to test the lasting-values of the various fertilizers used. The opinion is widely held that while basic slag and ground rock phosphate are slower in action than superphosphate their lasting-qualities are better. The table below gives the weights of hay cut from the plots. Cutting and weighing were done between 4th and 7th January, 1926.

Fertilizer used.	Amount per Acre.	Hay-yield per Acre.	Increase over Check per Acre.	Percentage Increase on Check.
Unlimed Plots.		Cwt.	Cwt.	
Check	No manure	13·2	..	..
Basic slag	3 cwt.	20·3	7·4	56
Superphosphate	3 ,,	24·2	11·0	83
Rock phosphate	3 ,,	21·3	8·1	61
Limed Plots.				
Superphosphate	3 ,,	22·6	9·4	71
Rock phosphate	3 ,,	16·7	3·5	26

Rainfall for 1925, 57·05 in. (average 60 in.). Number of rainy days, 160.

Comparing the yields of hay on the whole of the plots with those of the preceding seasons, the yields were low. This result is no doubt due in a large measure to the unfavourable season, as hay-yields throughout the district were generally below the average. The spring was wet, and cold westerly winds were fairly constant until the end of November, when the weather set in dry and warm. This, combined with the fact that the annual dressing of fertilizers was omitted, would account mainly for the lowered yields. The comparatively heavy yield of hay cut in 1924 may also have had a tendency to lower the yield in 1925.

The accompanying graph covers the whole period of the trials. It provides a useful means of making comparisons, not only between the individual treatments, but the yearly increases in hay-weights over and above the natural yield, which is taken from the check plots.



GRAPH SHOWING FIVE YEARS' RESULTS OF TE KUMI TOP-DRESSING TRIALS.

IMPROVEMENT IN PASTURE.

A visual inspection of the pasture on the different plots was made before haying, and the following notes were recorded :—

Super and lime : Good, dense sward, of good colour ; vigorous cocksfoot, and bottom growth of suckling-clover and dogstail. Considered best quality.

Nauru and lime : Very weak generally, with many weeds ; the appearance of fern showed lack of vigour in better grasses.

Super : Fairly good sward ; suckling-clover and dogstail forming the bottom, rye-grass and fog the top—the fog rather prominent.

Nauru : Pasture poor, with many weeds, except Plot 4, which was a great improvement, having red clover and timothy growing vigorously. Weeds present include soft brome, fog, and tarweed.

Check : Very poor, with fern increasing. Herbage very withered and brown ; chiefly fog, soft brome, linum, cudweed, and dandelion.

Slag : Fairly good bottom growth, of good colour ; chiefly white clover and dogstail, with small amounts of red clover and cocksfoot ; rib-grass, tarweed, and suckling-clover also present.

All plots contained large amounts of tarweed and a good deal of fog.

POINTS IN THE RESULTS.

The plots are in triplicate, and since the experiment has been repeated year after year for five years on the same ground we have repetition in time as well as on the field. Having the results of previous seasons as a guide it seems feasible that the differences in yield on the plots which are comparable are real. An examination of the yields and the graph indicates that superphosphate, both on the limed and unlimed plots, maintains its lead over the other manures. So far as last season's results go at Te Kumi, the evidence shows that the lasting benefit of superphosphate in the soil is not less than that of the other phosphates. This fact is one of the most interesting that emerges from the data available for the season, and experiments to test this point further would be worth while.

Arrangements have been made with the owner of the farm, Mr. Charles Harrison, to go on repeating the dressings of phosphates and cutting the plots for hay as opportunity offers. It is thought that, as the plots are large enough to impress farmers, and the seasonal factor can be taken into account when weighings are made from the same ground for a number of years, experiments should be continued further.

In the grazing of lucerne care has to be taken that the crowns of the plant are not eaten out. A large number of stock should be turned in for a short period and the crop fed down rapidly. It should then be closed up until ready for another grazing. Continuous grazing should be avoided, as it lessens the life of the stand,

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The mole drain-plough is most economical for certain types of clay land. When this method is employed the drains are usually spaced from 6 ft. to 9 ft. apart.

TWO RECENT CASES OF PLANT POISONING AMONG STOCK.

STRATHMORE WEED AND NGAIO.

W. M. WEBSTER, B.Sc., M.R.C.V.S., Departmental Veterinarian, Masterton.

THE writer has recently had an opportunity of investigating cases of poisoning of stock by two of the less generally known indigenous poisonous plants of New Zealand, and the following account is published with a dual purpose: firstly, to put on record as complete a history as possible of the symptoms and progress of the cases; secondly, to put the stockowner on his guard against the plants in question, and to aid him, through a recognition of the symptoms, in determining the source of trouble should a similar outbreak occur among his stock.

Strathmore Weed (Pimelia prostrata).

The first outbreak, which was brought under my notice by Mr. S. Fletcher, B.V.Sc., of Masterton, to whom I am also indebted for many of the clinical notes in this record, was due to the plant *Pimelia prostrata*, commonly known in the North Island as "Strathmore weed."

Pimelia prostrata is a small, creeping, shrubby plant with woody stems, belonging to the Thymelaeaceae or daphne family. The small oblong leaves tend to cluster at the terminal ends of the branches; flowers white, four-petalled, and waxen in appearance; berries round, white, and waxen, rather larger than a pin's head. If the stalk is chewed it produces after a short period a burning sensation in the mouth, which persists for some time. The plant is quite common, especially in rougher country. (A full botanical description is given in Cheeseman's "Manual of the New Zealand Flora," 1925.)

The first published record of its poisonous properties was contained in this Department's Leaflet for Farmers, No. 55, cases having occurred among coach-horses in Taranaki in 1900. Then, in 1908, cases among draught horses in the Wairarapa district were reported by the *Dominion* of 4th September.

In the present instance, in the Wairarapa, three draught horses were affected. The animals were usually housed and stall-fed, but two days prior to the symptoms being first noted had been camped in a paddock in which there was growing a fair amount of *Pimelia prostrata*, where they were dry-fed from a trough but allowed to graze.

When first seen one animal ("A"), which subsequently died, showed symptoms of severe colicky pains. There was in all three cases profuse watery diarrhœa, without any trace of blood or mucous, marked depression, loss of appetite, and a strong disinclination to move about; pulse full, but slower than normal, and temperature normal.

On the following day all exhibited intense inflammation and soreness of the mucous membranes of the mouth and tongue, and showed a distinct objection to being handled about these parts. The diarrhœa was more copious and watery, depression and stiffness very marked, and temperature slightly subnormal in all cases.

Two days later all three animals still exhibited the same symptoms—profuse watery diarrhœa, depression, disinclination to move, and soreness of the mouth. In addition, the nictitating membrane or "haw" and conjunctiva of the eye were more or less œdematous and distinctly icteric or yellow, but with a greyish tint as well. This phenomenon was most marked in "A," in which the protruded haw showed several distinct facets—a most unusual appearance. The pulse was thready and difficult to detect in this case; temperature, 97·5° F. There was also marked muscular soreness, especially of the loins and hind limbs, which did not tend to pass off with forced exercise. "B" showed the faceted and icteric condition of the haw to a lesser extent; depression again very marked, temperature subnormal, but pulse much fuller. "C" agreed with "B," save that the depression was not quite so marked, and swelling was not present in the membranes of the eye, which were, however, injected and distinctly icteric.

On the fifth day there was considerable diminution of the symptoms in "B" and "C," diarrhœa being almost checked, pulse and temperature normal, eye improved, mouth not so sore. "A," on the other hand, had grown steadily worse, the pulse being almost imperceptible, muscular soreness and depression increased, and temperature still subnormal.

On the following day "A" died; "B" and "C" made an uninterrupted recovery.

A *post mortem* examination on "A" yielded the following: The mucous membrane of the mouth and tongue showed a number of lesions, chiefly on the under-surface of the latter, and varying from small vesicles to circumscribed ulcers, with complete destruction of the epithelium. The whole of the mucous surface was distinctly yellow in tint and acutely inflamed.* The mucous membrane of the œsophagus or "gullet" showed a patchy injection, giving it a marbled appearance. The lesions of the mouth were repeated in the stomach. In this organ they were confined to the œsophageal portion, and were most marked and numerous in the region of the junction of the œsophageal and glandular parts of the stomach. Along this line the ulceration was more or less continuous and irregular, and in most cases the necrotic membrane—almost black in colour—was still semi-adherent to the underlying tissues. The glandular portion of the stomach was slightly congested, but otherwise unaffected. The intestines showed many injected areas, but no marked lesions. There was an area of consolidation in the posterior lobe of the right lung. The liver was undergoing fatty degeneration, and was also icteric, being pale yellow in colour. The internal appearance of the carcase generally was not so icteric as was expected, considering the condition of the visible mucous membranes.

From the foregoing it appears that the toxic action of *Pimelia prostrata* is that of an intense irritant poison, but apparently it does not cause acute pain, because it exerts some narcotic effect in addition.†

* *Cf.* B. C. Aston, F.I.C., F.N.Z.Inst., in "The Poisonous, Suspected, and Medicinal Plants of New Zealand," *N.Z. Journal of Agriculture*, vol. 26, p. 149: (1) "The burning sensation produced in the mouth when the plant is chewed"; (2) " . . . the fresh bark of daphne applied to the skin produces inflammation followed by vesication . . ."

† *Cf.* (1) B. C. Aston, *l.c.*, " . . . the symptoms of daphne poisoning are severe purging, burning of the mouth and throat, and in severe cases narcotic effects"; (2) G. L. Lander, in "Veterinary Toxology," 1912, p. 257: " . . . the physiological effect . . . also exhibits marked nervous effects . . . the animal is drowsy . . ."

Treatment consisted of a stimulant and a purgative dose of linseed-oil in the first instance, followed by linseed-tea, Bismuthi carb., and strong coffee in liberal doses at four-hour intervals.

It may be added that the plant is apparently only dangerous to animals unused to it, as horses have continually grazed for years in the paddock in question without any ill effects. Whether they avoid the plant or become tolerant of its action is not definitely known.*

Since the foregoing another case has occurred in the same district, exhibiting similar symptoms, and with fatal results.

Ngaio (Myoporum laetum).

The second poisonous plant to which this record refers is the ngaio, or *Myoporum laetum*, common in coastal districts. It is a low-growing tree, much branched, having long, lanceolate, fleshy leaves, giving off a pungent aromatic odour when bruised; small, white, purple-spotted flowers, and small, oval, reddish-purple berries. (For a full botanical description see Cheeseman's "Manual of the New Zealand Flora.")

Previous cases of poisoning by this agent have been reported in May, 1910, August, 1912, and May, 1918.† The present instance occurred in south Wairarapa. Out of a bunch of thirteen two-and-a-half-year-old Hereford steers in good condition, and running in a 30-acre paddock containing an abundance of feed, three were found dead and two seriously ill. The paddock contained a number of ngaio and beech trees for shelter. A week previous to the outbreak a large limb of a ngaio, heavily laden with berries, had come down during a gale of wind, and there was ample evidence that a considerable quantity of the berries, leaves, and terminal twigs had been eaten.

The three dead animals were all lying as if resting, without the slightest indication of any *ante mortem* struggle.

On *post mortem* examination the rumen or "paunch" was found in each case fully packed with grass, but only in one case was a recognizable fragment of ngaio-leaves and a few berries found. The reticulum or "honeycomb" appeared normal in each case In each the omasum or "manyplies" was perhaps unduly distended, but the ingesta was normal in appearance. The many folds of mucous membrane, however, were injected, the capillaries being all engorged with blood and standing out in a remarkable manner. The abomasum or "fourth stomach" contained a small proportion of ingesta mixed with a considerable quantity of extravasated blood. The lining membrane was intensely inflamed, while the walls were thickened and congested. In each case, among the semi-fluid ingesta, the hard seeds of the ngaio-berries, unbroken and unaltered by the process of digestion, were present in large numbers, so numerous as to preclude any attempt at a count being made. The remainder of the intestinal tracts exhibited the same intense inflammation and congestion, and were empty save for small amounts of dark bloody exudate. The rectum in each instance contained a few small, hard, mucous-coated pellets largely composed of blood-clot. The kidneys appeared in a state of acute congestion, and

* *Cf.* Leaflet for Farmers, No. 55, N.Z. Department of Agriculture, 1900: "... that the weed is very injurious to strange horses, and that, as a rule, after they eat it once and recover they do not touch it again ..."

† B. C. Aston, *l.c.*

the bladder in all three cases contained a considerable quantity of urine of a characteristic deep-golden-orange colour. The hearts were unusually flabby and dilated. The remaining organs appeared normal.

The two bullocks still alive were lying about dull and listless, not feeding or cudding, but able to move off briskly when disturbed, without any loss of muscular control. Both were apparently suffering from acute constipation, as, despite a careful search, no trace of any recently voided dung could be found.

The most characteristic symptom observed in these animals was the extremely tucked-up appearance of the abdomen. The oblique abdominal muscles were fully tensed, so as to make the posterior border of the ribs stand out very distinctly (the so-called "pleuritic line"). This is indicative of acute abdominal pain, as would be expected from the *post mortem* findings in the dead animals.

As they were run cattle no closer examination could be made save in a crush, and this course was deemed inadvisable. For a similar reason no treatment was adopted, though demulcents and stimulants appeared indicated. Both animals recovered completely in the course of eight or nine days.

The symptoms of extreme constipation and colicky pains are in agreement with those described in previous outbreaks,* but the latter all occurred in late autumn and winter when other keep was scanty, and the paunches were in each instance packed with ngaio leaves and twigs. At this period of the year, too, the berries are absent. From the present cases—occurring early in March—and the severity of the symptoms it would appear that the berries and seeds are much more drastic in their toxic action and more intensely irritant in their effect than are the leaves and twigs by themselves. Further, from the absence of any evidence of struggle immediately prior to death, especially in view of the state of the internal organs as revealed in the *post mortem* examination, it would seem that ngaio also exercises powerful effects of a narcotic nature on the nervous system.

* B. C. Aston, *l.c.*

Handling of Stock in Transit to Freezing-works.—The annual report of the Meat-producers' Board for 1925–26 has the following remarks on this subject: "On various occasions the Board has pointed out to farmers and others the importance of the careful handling of live-stock whilst in transit to freezing-works, and, through the courtesy of the Railway authorities, it has had posters permanently displayed at all trucking-stations giving warning of the damage that occurs to stock through careless handling. As a result of a recent visit to different freezing-works the general manager has reported to the Board that there is still a great economic waste taking place owing to the bruised condition of stock arriving at the works. Many farmers are often concerned at the large percentage of second-class lambs as returned by the freezing companies, and are not aware that a great many of these lambs are placed in the second grade owing to bruises. A certain amount of this bruising occurs in railway-trucks, but, nevertheless, a great deal takes place before the lambs are railed and during trucking. In analysing the nature of these bruises there appears to be a lot of it caused through wool-pulls—that is, catching hold of the animal by the wool. It is essential that farmers should see that every care is given to the handling of their stock whilst *en route* to freezing-works. The monetary loss which occurs through bruising is very considerable, besides the bruising being detrimental to the appearance of our lambs when displayed on Smithfield."

WHEAT MANURIAL EXPERIMENTS IN CANTERBURY, SEASON 1925–26.

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IN continuation of the wheat manurial experiments the results of which were published in this *Journal* for April, 1925, further work was carried out in the same district in the 1925–26 season. Certain modications in the fertilizer mixtures used were made, and other quantities and treatments were added.

Blood, which hitherto had been used at the low rate of ¼ cwt. per acre with no significant effect, was increased in quantity to 1 cwt. per acre. Thus some 12 lb. to 13 lb. of nitrogen per acre was supplied. Potash in the form of sulphate, and an increased amount of phosphates, were also tried. The diversity of results is considerable, and each experiment will therefore be discussed separately.

It was intended that all experiments should be on autumn- or winter-sown wheats as in the past, but the season proved to be such an extraordinarily wet one that sowings of two of the experiments had to be left until the spring. The methods adopted for the sowing, harvesting, and threshing of crops were described in last month's issue of the *Journal*.

NOTE.—In various places in the tabular statements presented it will be noticed that different yields are shown for the same treatment in a particular experiment. This is due to the fact that the mean has been calculated from different combinations or from different numbers of plots. In making comparisons care has been taken to pair plots which were most closely situated to one another.

EXPERIMENT 1, ON FARM OF J. FOSTER, LADBROOK'S.

These plots were sown on 20th May, 1925, and harvested on 2nd February, 1926; variety, College Hunter's; seeding, 1½ bushels per acre. The experiment was carried out in the same field as that used the previous year. The history of the field was—wheat in 1924-25, and grass for three years prior to that crop.

The treatments per acre were—

(1.) Control (no manure).
(2.) Superphosphate, 42/44 per cent. tricalcic phosphate .. 1 cwt.
(3.) Superphosphate, 42/44 per cent. .. .. .. 2 cwt.
(4.) Basic super, 40/43 per cent. .. .. 1 cwt.
(5.) Basic super, 40/43 per cent. .. .. 2 cwt.
(6.) Basic super, 1 cwt., plus dried blood, 1 cwt. .. .. 2 cwt.
(7.) Super, 1 cwt., plus dried blood, 1 cwt. .. .. .. 2 cwt.
(8.) No. 7 mixture, plus ½ cwt. sulphate of potash .. .. 2½ cwt.

Six replications of this series were sown, all plots being 3 chains in length. The division into two at harvest gave twelve determinations of yield of each treatment, the mean of the differences between paired plots being calculated. This area suffered badly in the winter months, patches being almost drowned out; hence variation in the yield of plots of the same treatment was considerable, increasing the difficulty of arriving at conclusive results.

NOTE.—Two extra plots sown with super at the rate of 1 cwt. per acre were included in each series. These were to be used as a "way" for the binder in the event of delayed ripening of controls, which would have been cut when ripe. No appreciable differences in ripening occurred, so that the plots were actually used for yield determination.

Observations during Growth.

9th September, 1925: All manured plots showed a marked superiority in growth over controls. Basic super, 1 cwt., plots were the poorest of the manures, and super at 2 cwt., super plus blood, and super plus blood plus potash were the most strongly grown.

15th October: Growth of controls still inferior, but colour much deeper than manured plots, which had a yellowish tinge. The whole were very uneven on account of extremely wet conditions.

12th January, 1926: All plots very weedy, and differences not determinable with any degree of certainty.

Comparisons which have been made are shown in Table 1.

Table 1.—Results of Experiment 1.

Number of replications, 6 (except super, 1 cwt. per acre). Each plot divided into two. Area of individual plot, $\frac{1}{107.7}$ acre. > = greater than.

Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
		Bushels.	Bushels.		
A. Super, 1 cwt. ..	15	38·3	4·4	>9999	Difference significant.
B. Control.. ..	..	33·9			
A. Basic super, 1 cwt.	11	34·7	1·0	4	Difference not significant.
B. Control.. ..	..	33·7			
A. Super, 2 cwt. ..	12	36·8	0·8	3·6	Difference not significant.
B. Super, 1 cwt. ..	..	36·0			
A. Basic super, 2 cwt.	12	38·6	3·7	1666	Difference significant.
B. Basic super, 1 cwt.	..	34·9			
A. Super, 1 cwt. ..	12	36·0	1·1	3·6	Difference not significant.
B. Basic super, 1 cwt.	..	34·9			
A. Basic super, 2 cwt.	12	38·5	1·7	7	Difference not significant.
B. Super, 2 cwt. ..	..	36·8			
A. Basic super, 1 cwt., + blood, 1 cwt.	12	40·5	5·6	1700	Difference significant.
B. Basic super, 1 cwt.	..	34·9			
A. Super, 1 cwt., + blood, 1 cwt.	12	39·1	1·3	2·8	Difference not significant.
B. Super, 1 cwt. ..	..	37·8			
A. Super, 1 cwt., + blood, 1 cwt., + potash, ½ cwt.	12	41·8	2·7	27	Difference barely significant.
B. Super, 1 cwt., + blood, 1 cwt.	..	39·1			

Readers are reminded that where the odds shown in column 5 are less than 30 to 1 the difference is not regarded as a real one.

NOTE.—Prices of manures per ton at country stations for 1925 were: Super, 42/44, £7; basic super, £6 10s.; dried blood, £14; sulphate of potash, £19. In evaluation of increase 5s. per bushel is taken as the value of wheat.

Comments on Table 1.

(1.) Super at the rate of 1 cwt. per acre shows an increase of approximately 4½ bushels per acre over control. At 5s. per bushel this is worth £1 2s. 6d., and is obtained at a cost of 7s; hence the profit per acre is about 15s. 6d. In the previous season super on this paddock gave an increase of nearly 6½ bushels per acre.

(2.) Basic super at the rate of 1 cwt. per acre shows an increase of only 1 bushel per acre, which is not a statistically significant one. In view of the result from super this small difference is probably a real one, but is too small to be regarded as profitable.

(3.) The addition of the second hundredweight of super has not given a significant increase over the first.

(4.) The 2 cwt. quantity of basic super has increased the yield over that of 1 cwt. of the same manure by a considerable amount—3·7 bushels per acre. Allowing that the 1 cwt. increase of 1 bushel over control is significant, the second hundredweight will show an increase over control of 4·7 bushels per acre. This is profitable, but not to the same extent as 1 cwt. of super.

(5.) The superiority of super, 1 cwt., over basic super, 1 cwt., is not significant.

(6.) The superiority of 2 cwt. basic super over 2 cwt. super is not significant.

(7.) 1 cwt. of blood added to 1 cwt. of basic super has caused an increase of approximately 5½ bushels per acre, the value of which is £1 7s. 6d., and the cost of blood 14s. A profit of 13s. 6d. per acre results.

(8.) The addition of blood to superphosphate has not resulted in a certain increase.

(9.) The chances of 27 to 1 in favour of ½ cwt. of sulphate of potash causing an increase of 2·7 bushels per acre give very nearly practical certainty, but if the increase is real it is profitable to the extent of only 4s. per acre.

As already indicated, the great variation of the crop due to drowning makes the results difficult of interpretation.

EXPERIMENT 2, ON FARM OF F. W. CARPENTER, PREBBLETON.

Dates sown, 1st and 6th June, 1925; date harvested, 1st February, 1926; variety, Solid-straw Tuscan; seeding, 1¾ bushels per acre. History of the paddock: 1924–25, wheat; 1923–24, oats; 1922–23, potatoes. Prior to 1922 the ground was in grass for six years, and for a period had been used as a pig-paddock.

The treatments were as detailed for the previous (Ladbrook's) experiment. Hard experience has here provided us with a valuable

lesson in the matter of sowing under uniform conditions. The control, 1 cwt. super, and 2 cwt. super plots were sown on 1st June. The work was not completed on that day, and the intervention of rain prevented sowing of the remainder of the plots until 6th June. Irregularities, which cannot be attributed to anything else than this difference in time of sowing, are evident, and are discussed below. Comparisons have been made only between treatments sown on the same day, and are shown in Table 2.

Table 2.—Results of Experiment 2.

Number of replications, 10. Plots not subdivided. Area of individual plot, $\frac{1}{111 \cdot 1}$ acre.

Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
		Bushels.	Bushels.		
(A.) *Plots sown 1/6/26.*					
A. Super, 1 cwt. ..	15	48·8	1·1	40	Difference significant.
B. Control.. ..	..	47·7			
A. Super, 1 cwt. ..	10	48·1	1·5	32	Difference significant.
B. Super, 2 cwt. ..	..	46·6			
(B.) *Plots sown 6/6/26.*					
A. Basic super, 2 cwt.	10	45·2	0·7	4	Difference not significant.
B. Basic super, 1 cwt.	..	44·5			
A. Basic super, 1 cwt., + blood, 1 cwt.	10	48·6	4·1	132	Difference significant.
B. Basic super ..	..	44·5			
A. Super, 1 cwt., + blood, 1 cwt.	8	49·1	0·3	1·5	Difference not significant.
B. Super, 1 cwt., + blood, 1 cwt., + potash, ½ cwt.	..	48·8			

Comments on Table 2.

The table is divided into two parts—the comparison of plots sown (A) on 1st June, and (B) those sown on 6th. It is not likely that the actual time in difference of sowing was of consequence, but what is probable is that the difference in the condition of the soil was a disturbing factor. On examination it was found that the basic super 1-cwt.-per-acre plots gave a significantly lower yield than control. The truth of this is so improbable that it must be concluded that the difference in the sowing-conditions had an influence.

Section A, plots sown 1/6/26: (1.) 1 cwt. super shows an unprofitable but significant increase of 1 bushel per acre. Differences between treatments sown on the same day were never evident.

(2.) Super, 2 cwt., actually shows a depression in yield as compared with super, 1 cwt. This is difficult to account for.

Section B, plots sown 6/6/26: (1.) Basic super at 2 cwt. per acre has given no certain increase over the 1 cwt. quantity.

(2.) The addition of 1 cwt. blood to 1 cwt. basic super has caused an increase of just over 4 bushels per acre, and a resulting profit of about 6s. 6d.

(3.) The addition of sulphate of potash to the super-and-blood mixture has proved a dead loss.

It is interesting to notice that super and blood applied on 6th June gave a yield of 49·1 bushels per acre. If this treatment had been adversely affected by the conditions of later sowing, as it is surmised the basic super was, then it might be expected that the super-and-blood combination and its potash addition mixture would have yielded about 52 bushels per acre. This is mere supposition, and, unfortunately, it is impossible to test its validity.

EXPERIMENT 3, ON FARM OF W. AND A. CAMPION, PREBBLETON.

Date sown, 3rd October, 1925; date harvested, 26th July, 1926; variety, Solid-straw Tuscan; seeding, 2 bushels per acre. History of paddock: 1924–25, potatoes, preceded by winter fallow and three years of grass.

The treatments were as for the preceding experiments, with the exception that the basic-super-plus-blood mixture was not included.

Observations during Growth.

The area was visited on 12th January, 1926, and the superiority of manured plots over the controls was very evident. Basic super at 1 cwt. per acre was the poorest of the manured plots in appearance, the super plus blood and super plus blood plus potash being the best. All others (super, 2 cwt.; super, 1 cwt.; and basic super, 2 cwt.) appeared to be about equal.

Comments on Table 3.

The interpretation of results from the spring-sown crops is much more satisfactory and conclusive:—

(1.) 1 cwt. super has caused an increase of nearly 3½ bushels per acre, the value of which is 17s., and the net profit resulting equals 10s. per acre.

(2.) The same quantity of basic super shows a profit of only 3s. per acre resulting from its use.

(3.) 2 cwt. super gave a 2·1-bushel-per-acre increase over the 1 cwt. quantity, and a consequent further profit of 3s. 6d.

(4.) The second hundredweight of basic super gave no statistically significant increase over the 1 cwt. quantity, although the chances of 21 to 1 are approaching practical certainty. In any case the increase is not a profitable one.

(5.) 1 cwt. super has proved decidedly better than 1 cwt. basic super.

(6.) Similarly, 2 cwt. super has proved superior to 2 cwt. basic super.

(7.) 1 cwt. blood, although increasing the yield when added to super by approximately 1½ bushels per acre, has not been a profitable application.

(8.) ½ cwt. sulphate of potash has had no beneficial effect.

Table 3.—Results of Experiment 3.

Number of replications, 7. Each plot divided into three. Area of individual plot, $\frac{1}{88 \cdot 9}$ acre.

Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
		Bushels.	Bushels.		
A. Super, 1 cwt. ..	21	32·1	3·4	>9999	Difference significant.
B. Control.. ..	..	28·7			
A. Basic super, 1 cwt.	21	30·6	1·9	384	Difference significant.
B. Control.. ..	..	28·7			
A. Super, 2 cwt. ..	21	34·2	2·1	>9999	Difference significant.
B. Super, 1 cwt. ..	..	32·1			
A. Basic super, 2 cwt.	21	31·3	0·7	21	Difference not significant.
B. Basic super, 1 cwt.	..	30·6			
A. Super, 1 cwt. ..	21	32·1	1·5	800	Difference significant.
B. Basic super, 1 cwt.	..	30·6			
A. Super, 2 cwt. ..	21	34·2	2·9	>9999	Difference significant.
B. Basic super, 2 cwt.	..	31·3			
A. Super, 1 cwt., + blood, 1 cwt.	21	33·7	1·6	384	..
B. Super, 1 cwt. ..	..	32·1			
A. Super, 1 cwt., + blood, 1 cwt.	21	33·7	0·6	9	Difference not significant.
B. Super, 1 cwt., + blood, 1 cwt., + potash, $\frac{1}{2}$ cwt.	..	33·1			

EXPERIMENT 4, ON FARM OF F. W. CARPENTER, PREBBLETON.

Date sown, 6th August, 1925; date harvested, 8th February, 1926; variety, Solid-straw Tuscan; seeding, $1\frac{3}{4}$ bushels per acre. Preceding crop, Italian rye-grass.

The manurial treatments per acre were as follows:—

(1.) Control.
(2.) Super (42/44 per cent.), 1 cwt.
(3.) Super, 1 cwt., plus sulphate of potash (48 per cent. K_2O), $\frac{1}{2}$ cwt.
(4.) Super, 1 cwt., plus dried blood, 1 cwt.
(5.) Super, 1 cwt., plus nitrate of soda, 176 lb.
(6.) Super, 1 cwt., plus nitrate of soda, 93 lb.
(7.) Super, 1 cwt., plus sulphate of ammonia, 83 lb.
(8.) Super, 1 cwt., plus sulphate of ammonia, 71 lb., plus sulphate of potash, $\frac{1}{2}$ cwt.

The super was sown with the grain in each plot, as also was the dried blood and sulphate of potash (Plots 3 and 4). All nitrate of soda, sulphate of ammonia, and the sulphate of potash on Plot 8 were top-dressed on 25th September, about seven weeks after sowing of seed. With the exception of Plot 5, which received nitrate of soda at the rate of 176 lb. per acre, it was intended that the amount of nitrogen supplied

in the form of nitrate of soda and sulphate of ammonia should equal that contained in 1 cwt. of blood—85 lb. of the former and 67 lb. of the latter would supply the desired amount. Difficulty was experienced in getting the material to run freely, and the exact quantities were not sown (see schedule of manures above).

Observations during Growth.

On 15th October, 1925, about ten weeks after sowing, the control plots were decidedly inferior to all manured plots, and the super and blood was quite the best plot.

On 25th October the effect of the nitrogen was much in evidence on all plots, but especially on those which received the heavy dressing of 176 lb. of nitrate of soda. The greater growth and deeper green colour of the nitrogen plots were maintained until the crop ripened. The plots receiving super alone and super and potash, although superior to the controls in growth for a considerable time, were hardly distinguishable from them at harvest-time.

Comments on Table 4.

NOTE.—Nitrate of soda, £20 per ton, 15·5 per cent. nitrogen approximately; sulphate of ammonia, £22 per ton, 20 per cent. nitrogen approximately; dried blood, £14 per ton, 12 per cent. nitrogen approximately.

(1.) 1 cwt. super has caused a significant but unprofitable increase of 1 bushel per acre. This result proved unexpected, as the evident superiority of the super plots in the earlier stages indicated a considerable increase in yield.

(2.) ½ cwt. sulphate of potash added to the super has had no effect on yield.

(3.) 1 cwt. blood added to the phosphate has caused a profitable increase of 5·2 bushels per acre.

(4.) Nitrate of soda applied at the rate of 176 lb. per acre shows a net return of 16s. 6d. per acre.

(5.) Nitrate of soda at 93 lb. per acre has caused an increase of 5·9 bushels, and a net profit of about 13s. per acre.

(6.) Sulphate of ammonia at 83 lb. per acre has been profitable to the extent of about 9s. per acre.

(7.) The addition of ½ cwt. sulphate of potash has not been profitable. The depression in yield below that of super and sulphate of ammonia may be due to the lesser quantity (12 lb.) of sulphate of ammonia. On the other hand, the potash may have been responsible for the depression.

(8.) The comparison of the two quantities of nitrate of soda is to the disadvantage of the heavier quantity, the increase of 2·6 bushels of wheat not being sufficient to pay for the extra 83 lb. of nitrate. (In comparison above it will be noticed that the mean of 1-cwt.-super-per-acre plots, with which the 176 lb. quantity of nitrate of soda is compared, is considerably lower than the mean of those with which the 93 lb. of nitrate of soda is compared.)

(9.) Both nitrate of soda and sulphate of ammonia show a considerably better yield than does blood when a direct comparison is made.

(10.) The quantity of nitrogen supplied in the soluble salts is slightly higher than that in blood. It seems unlikely that this small difference would be wholly responsible for the difference in yield. The time of application and greater availability of the soluble salts are more likely to be responsible.

Table 4.—Results of Experiment 4.

Number of replications, 10. Each plot divided into two. Area of individual plot, $\frac{1}{80}$ acre. All plots received super at 1 cwt. per acre.

Comparison, A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Odds.	Remarks.
		Bushels.	Bushels.		
A. Super	30	27·8	1·0	130	Difference significant.
B. Control.. ..	..	26·8			
A. Super	20	26·4	..	..	Difference not significant.
B. Super, + potash, ½ cwt.	..	26·5			
A. Super, + blood, 1 cwt.	20	31·6	5·2	>9999	Difference significant.
B. Super	..	26·4			
A. Super, + nitrate of soda, 176 lb.	20	36·6	9·7	>9999	Difference significant.
B. Super	..	26·9			
A. Super, + nitrate of soda, 93 lb.	20	34·5	5·9	>9999	Difference significant.
B. Super	..	28·6			
A. Super, + sulphate of ammonia, 83 lb.	20	33·7	5·1	>9999	Difference significant.
B. Super	..	28·6			
A. Super, + sulphate of ammonia, 83 lb.	20	33·7	1·1	90	Difference significant.
B. Super, + sulphate of ammonia, 71 lb. + potash, ½ cwt.	..	32·6	..	..	Note slightly lower amount of sulphate of ammonia in B.
A. Super, + nitrate of soda, 176 lb.	18	36·8	2·6	>9999	Difference significant.
B. Super, + nitrate of soda, 93 lb.	..	34·2			
A. Super, + nitrate of soda, 93 lb.	20	34·5	2·9	>9999	Difference significant.
B. Super, + blood, 1 cwt.	..	31·6			
A. Super, + sulphate of ammonia, 83 lb.	20	33·8	2·2	832	Difference significant.
B. Super, + blood, 1 cwt.	..	31·6			

GENERAL CONCLUSIONS.

(1.) In the 1925–26 season phosphatic manures did not give the same marked response as in the preceding season, when the average increase due to 1 cwt. of super from six experiments was 7 bushels per acre. 1 cwt. of super has given decided increases in all four experiments, but on only two of these has its application been profitable.

(2.) On the whole, the application of 2 cwt. of phosphate has not been as profitable as 1 cwt.

(3.) Basic super has in no case proved superior to super, and in one case (Experiment 3, spring-sown) has been decidedly inferior.

(4.) In no case has ½ cwt. sulphate of potash added to phosphate been instrumental in increasing yield.

(5.) The addition of 1 cwt. dried blood to 1 cwt. phosphate has proved profitable in three cases out of five (as an addition to either super or basic super), and in the one experiment in which nitrate of soda and sulphate of ammonia were used both treatments have quite justified their application. This effect of nitrogen is contrary to popular belief, and in such an abnormal season the results are likely to be extraordinary. The winter was the wettest recorded for many years, and excessive leaching of nitrates must have resulted.

(6.) The diversity of results lends further emphasis to the necessity for experiments such as these being carried out for a number of seasons on particular classes of soil before any generalizations can be made.

ACKNOWLEDGMENTS.

The Department is indebted to those farmers on whose farms the work was conducted for their continued keen interest and assistance. To Messrs. Bates, Montgomery, Calder, Claridge, and Bryden, who at various times have assisted in these and other experiments which will be discussed later, thanks are due for the care and energy put into their work in the field and in the tedious compilation of results.

Lamb Export Trade. – The Meat-producers' Board report for 1925–26 remarks: "The greater demand for our lambs on the British market commences after Easter. Like all other markets, the British meat trade can absorb a certain amount of lamb in the off season, and early shipments of new season's lamb often realize good prices. But shippers and producers must recognize that the requirements of the Home trade must be carefully studied, and an oversupply of lambs before the lamb-eating season commences in Britain should be avoided. In observing the requirements of the Home market in this respect producers must also take into account the most economical time for the farming of the early lambs, having regard to the period when there is a greater abundance of feed."

Compensation for Stock and Meat condemned.—Compensation to the amount of £16,212 was paid out during the year 1925–26 for 5,747 animals condemned in the field for diseases under the Stock Act, and £14,671 for carcases or parts of carcases condemned for disease on examination at time of slaughter at abattoirs and meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

STAGE OF CUTTING COCKSFOOT FOR SEED.

R. J. VEALE, Canterbury Agricultural College, Lincoln.

COCKSFOOT-SEED cut on Banks Peninsula frequently has a germination lower than might reasonably be expected, and it has often been suggested that this is due to too early cutting. The probability that this is the case was emphasized by a statement made by one well acquainted with the business, to the effect that cocksfoot may be cut almost as soon as the anthers have fallen, because the seed will ripen in the straw.

A small experiment was therefore designed to see if the early cutting thus advocated had or had not a deleterious effect on the germination. A single strain of cocksfoot was taken and the seed-heads marked immediately all the anthers had fallen. These heads were cut at three different stages—namely, four, eight, and twelve days after the fall of the anthers. After the seed had ripened ready for threshing the heads from each stage of cutting were gathered and threshed separately. A month later the three samples of seed were tested for germination percentage. Five lots from each stage of cutting were taken, and the whole fifteen were germinated under the same conditions.

After twenty-one days in the germinator the results were as follows :—

Seed cut 4 days after anther-fall		germinated	$17 \pm 5{\cdot}5$ per cent.
,, 8	,,	,,	$28 \pm 5{\cdot}0$,,
,, 12	,,	,,	$34 \pm 3{\cdot}9$,,

This gives a difference of $17 \pm 6{\cdot}4$ per cent. in favour of the seed cut twelve days after the fall of the anthers as against that cut four days after.

The experiment was repeated with another strain of cocksfoot, with the following result :—

Seed cut 4 days after anther-fall		germinated	$13 \pm 1{\cdot}4$ per cent.
,, 8	,,	,,	$20 \pm 1{\cdot}6$,,
,, 12	,,	,,	$33 \pm 2{\cdot}4$,,

This gives a difference of $20 \pm 2{\cdot}7$ per cent. in favour of the twelve-day cutting as against cutting four days after the anthers fall.

It is clear that even twelve days after the anthers fall is too early to cut, and that the very early cutting sometimes recommended causes heavy losses in germinable seed.

The seed-heads that were cut twelve days after the fall of the anthers were just beginning to turn from green to brown, but it would have been another eight or twelve days after this stage before there was any danger of the seed falling out during cutting.

Before the bush was felled from the hills at Akaroa the cocksfoot was cut at a riper stage than that at which it is being cut at present, owing to there being then less danger of the seed shaking out with the wind ; but it seems that the early stage of cutting has been carried too far and has seriously affected the germination of the seed.

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1925-26.

J. W. DEEM, Instructor in Agriculture, Wanganui.

THE weather conditions experienced during the past year in the Marton district have been exceptional. The winter of 1925 was wet but fairly mild; the spring was rough and wet, and seriously retarded the sowing of most crops. The early summer was dry, and consequently most of the crops made slow growth, which was fortunate in some ways, as January was exceptionally wet, and if the crops had been ready to harvest at the usual time they probably would have been badly damaged. The autumn, however, was dry, allowing nearly all the crops to be saved in very fair condition. Despite the difficult season, the returns from the area may be considered satisfactory.

Details of the year's rainfall are as follows:—

Table 1.

Month.	Number of Wet Days.	Month's Rainfall.	Average Rainfall, Fifteen Years.	Month.	Number of Wet Days	Month's Rainfall.	Average Rainfall, Fifteen Years.
1925.		Inches.	Inches.	1926.		Inches.	Inches.
July ..	14	2·45	3·72	January ..	15	6·91	3·04
August ..	18	3·07	2·98	February	14	3·77	2·30
September	16	6·31	3·47	March ..	11	2·47	2·51
October ..	17	2·04	4·72	April ..	9	1·37	2·21
November	10	3·26	4·16	May ..	24	7·86	3·26
December	5	1·46	3·27	June ..	13	2·69	3·82

From the table it will be noticed that during the past year the months of September, January, and May had a rainfall much in excess of the average fall for these months respectively, while December and April were well below the average.

The total area under crop during the past year was slightly less than in the preceding season, due to the sowing-down of 4 acres in brown-top, 5 acres in Lotus major, and 3 acres of white clover for further trials. The areas sown in the various crops were: Wheat, variety trial, 5 acres; oats, variety trial, 9 acres; Black Skinless barley, $2\frac{1}{2}$ acres; Early Minto peas, $2\frac{1}{4}$ acres; William Hurst peas, $\frac{3}{4}$ acre; Moumahaki vetches, 1 acre; and small plots of turnips, swedes, and maize. The remainder of the Area was down in pasture, lucerne, and white-clover plots. Top-dressing trials were carried out on the pastures and lucerne.

CROPS.

Wheat Variety Trials.—These trials were carried out in Field 6, the following varieties being grown: Queen Fan, Queen Fair, Turretfield Eclipse, Jumbuck, and Major. The plots, each an acre in area, were

sown on 16th October. Early growth was slow, but afterwards fairly good growth was made, and the wheats filled well. Rust was in evidence, but not very badly, and no variety seemed to be more heavily infected than any of the others. The Major variety was the only one showing smut in any amount. All the varieties ripened about the same time, but unevenly, and were cut about the middle of February, with the following results:—

Table 2.

Variety.	Yield, 1926.	Average Yield, Two Years.	Remarks.
	Bushels.	Bushels.	
Turretfield Eclipse ..	42	40	Good sample; strong straw; hardly touched by birds.
Jumbuck	38	40	Very nice sample; good straw; birds very severe.
Queen Fan ..	36	38½	A little smut; very fair sample.
Queen Fair ..	33½	38¾	Very similar to Queen Fan.
Major	31	..	Bad with smut; sample only fair; birds took a good deal.

It will be seen that Jumbuck and Turretfield Eclipse have the same average yield for two seasons. Jumbuck, however, is the better sample, and it is intended to sow a larger area of this wheat next year. The Turretfield Eclipse should be a good wheat to grow where birds or wind are usually limiting factors in the yield of wheat.

Black Skinless Barley.—This crop was sown on 21st October, and although the season was not the best for barley the very fair yield of 34 bushels per acre was obtained. This variety is becoming fairly popular in the surrounding districts as a green fodder crop, but not much was sown in the past autumn on account of dry weather.

Field-peas.—Early Minto and William Hurst peas were sown in Field 7 on 3rd November, but made slow growth until the New Year. The latter variety was affected with collar-rot, and only 5¼ bushels of seed could be saved. Early Minto, however, was a very fair crop, and yielded 37½ bushels per acre.

Vetches.—The Moumahaki vetches sown in the same field at the same time made very slow growth, and were so late in coming to maturity that they could not be cut until the middle of April. Wet weather from then on spoilt all chance of harvesting them, and they had to be ploughed under.

Algerian Oats for Chaff.—In Field 8, 2¼ acres each of Australian, College, North Island, and South Island Algerian oats were sown on 10th October as a trial for the best yield of chaff. It was not until January that they made any real growth, and when cut about the middle of February they were only a fair crop. When the different strains were growing there was no very pronounced difference in them, the College oats being a little better perhaps on account of their stooling quality. While standing in the stook it was noticeable that the College had the brightest and cleanest straw, and slightly fuller heads.

The various lots were harvested and stacked separately, cut for chaff, and the resulting chaff weighed, with the following results per

acre: College, 1·07 tons; South Island, 0·93 tons; North Island, 0·91 tons; Australian, 0·72 tons. The yield of the Australian oats was lowered slightly owing to one side of the plot being shaded by a belt of pine-trees, but even then they did not appear to be quite so good as the North Island strain.

Roots.—Small plots were also sown for various tests with swedes, soft turnips, and mangolds.

The swedes, with the exception of two Danish varieties, were from David Bell, Ltd., and all produced fairly good crops. A cold snap in April checked the aphis and moth just when they threatened to damage the crop. Club-root was noticed on one variety only, and that not very bad. The roots were pulled and weighed on 16th June, when several of each variety were cut open to test their keeping-qualities. Results were as follows:—

Table 3.

Variety.	Yield.	Condition.
	Tons cwt.	
D.B. Improved Bronze-top ..	45 15	Quite sound, and nice quality.
D.B. Bell's Mervue	43 19	,, ,,
Wibollt's Giant Purple-top ..	41 19	Quite sound, and very fair quality.
D.B. Crimson King ..	41 4	Quite sound; slight club-root.
D.B. Best of All	40 19	Quite sound, and good quality.
D.B. Improved Purple-top ..	39 8	,, ,,
D.B. Prima Donna	39 3	,, ,,
D.B. Superlative	37 18	Going off; thinned a little wider than rest.
Studsgaard's Purple-top ..	30 17	Going off; smaller than rest and more side roots.

The soft turnips were Danish strains, some of which did fairly well, while others were only fair. They were carried on until the middle of June to test their keeping-qualities, and it was found that Dales Hybrid Amagergaard V and Fynsk Bortfelder were quite sound, that Ostersundom Amagergaard and Yellow Tankard Pajbjerg were going off, and that White Tankard Roskilde and Greystone Amagergaard were very fuzzy. The first two would appear to be good keepers, while the latter two were best for early feeding. The four varieties specially referred to have done fairly well and are worth another trial, although at present they do not appear to be better than our standard varieties.

The two mangold varieties, Barres Stryno VI and Danish Fodder sugar-beet, were fair croppers and of nice quality, but grew a little too far into the ground.

CLOVERS.

White.—The plot of imported wild white clover sown in 1923 made very good growth throughout the season, as also did the genuine Canterbury white sown in 1924. These areas were shut up for a seed crop, and it was very noticeable that, whereas the colonial clover was a mass of flowers, the wild white had very few flowers but an abundance of leaf. Owing to the scanty flowers on the wild white and the lateness of the season it was not worth while attempting to save the seed, so

sheep were turned on to graze the two areas. The sheep showed a slight preference for the wild white and grazed it barer than the colonial. On again shutting up the paddock the wild white was quicker to come

FIG. 1. PLOT OF IMPORTED WILD WHITE CLOVER AT MARTON EXPERIMENTAL AREA.
Note the very few flower-heads. Photo taken 8/3/26.

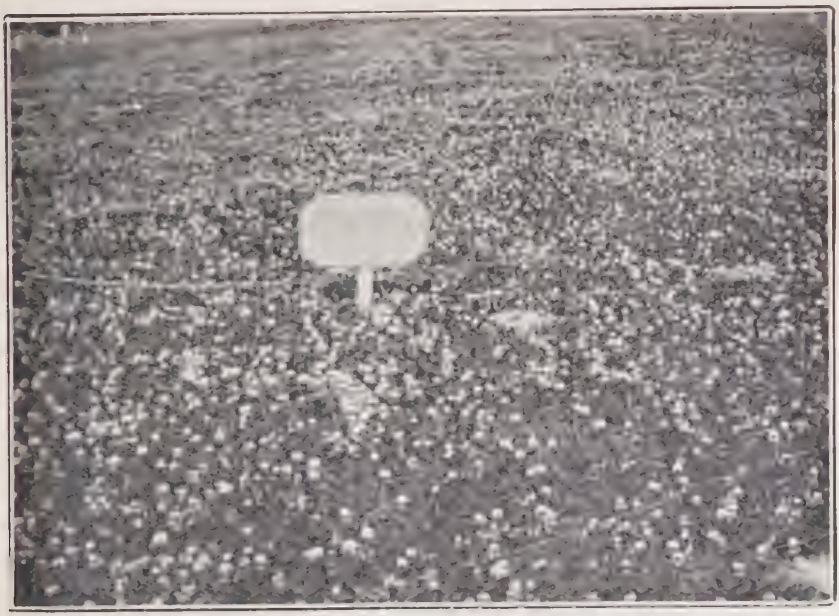

FIG. 2. COLONIAL WHITE CLOVER ON ADJACENT PLOT.
Showing abundance of flower-heads. Photographed 8/3/26.

away and produced practically no flower-heads, whereas the colonial was slower coming away and produced a fair number of flower-heads.

In order to extend these trials and, if possible, carry out some sheep-carrying tests three further areas, each $\frac{9}{10}$ acre, were sown in December with wild white (half the area sown with imported seed and half with seed saved from our own plot the previous year), genuine Canterbury white, and ordinary imported white. So far all have done about equally well, excepting for the fact that the seed of our own saving gave a germination of only 50 per cent., due to the large percentage of hard seeds. It is noticeable that, while the Canterbury and wild white varieties tend to spread over the ground, the ordinary imported white is tending to grow up off the ground.

Further areas were also sown in April with genuine imported wild white, Marton-grown wild white, wild white saved from a paddock of Mr. W. Wybourne, Whenuakura, wild white once grown from imported seed at Blenheim, and genuine Canterbury white. From all these plots it is hoped that in the future some useful data will be forthcoming as to the relative merits of the various strains and their worth to the farmer.

Red.—During April the following red clovers were sown to carry out trials similar to those with white clovers: Garton's Single-cut Late-flowering Red, Montgomeryshire-grown, Vale of Clywd (Welsh) Late-flowering Red, ordinary imported red, and genuine Canterbury red. Each plot is about an acre, and the clovers were sown with a mixture of perennial and Italian rye-grass. The two late-flowering varieties are coming into prominence in England, where it is claimed that they are more permanent than the ordinary red clover, and it will be interesting to see how they compare under our conditions with the varieties usually at the disposal of the farmer.

LUCERNE.

The lucerne area, which has just about served its period of usefulness, was top-dressed during the winter, and gave one fair and two small cuts during the year. Weights were taken on the various areas for two of the cuts, but the third, due to the dry autumn, was so light as to be not worth weighing. The scheme of top-dressing was: (1) A strip with super at 2 cwt. per acre and no lime; (2) a strip with no lime and no manure; (3) the rest of the field, lime $\frac{1}{2}$ ton and super 2 cwt. per acre. The green weights of the two weighings made were as follows:—

Table 4.

Treatment.	First Cut.	Second Cut.	Total.
	Tons cwt.	Tons cwt.	Tons cwt.
Lime, $\frac{1}{2}$ ton; super, 2 cwt.	9 13	2 11	12 4
No lime; super, 2 cwt.	9 12	2 8	12 0
No lime or manure	7 17	1 15	9 12

The no lime and no super weights are hardly a true criterion of the difference due to manure, as on this area more grass and weeds were cut and weighed than on the manured areas, where the more vigorous growth of lucerne kept the grass and weeds in check.

Weighings were also made on the areas devoted to drill-width trials, and the results for six seasons are given in Table 6. Here, again, the results are hardly a true indication of the actual weights of lucerne, as on the wider drills more grass and weeds were weighed than on the broadcast and 7 in. drills.

Table 5.

Year.	Number of Cuts.	Broadcast.	7 in. Drills.	14 in. Drills.	21 in. Drills
		Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.
1920–21 ..	3	17 0	17 5	17 0	14 14
1921–22 ..	4	25 10	19 14	22 12	21 8
1922–23 ..	3	18 15	17 13	18 4	16 12
1923–24 ..	3	15 15	14 17	14 4	13 6
1924–25 ..	3	18 7	15 14	17 18	15 4
1925–26 ..	3 (only 2 weighed)	12 16	12 1	12 6	11 7
Average per cut	..	6 0$\frac{1}{6}$	5 8	5 13$\frac{1}{2}$	5 5

PASTURES AND TOP-DRESSING.

The pastures did fairly well during the year, but the hay crops were not quite so good as in previous years, especially the second cut of clover off Field 4. Weighings were again made in Fields 1 and 4 on the top-dressing trial areas between ordinary ground Nauru phosphate and specially fine-ground Nauru. For the laying-off of these plots readers are referred to the Marton Area report for 1924–25, published in the *Journal* for August, 1925, page 118. The average weights of green material, obtained by twenty weighings on each $\frac{1}{2}$-acre plot, have been recorded for the two years 1924–25 and 1925–26, and the main results may be summarized as follows:—

Field 1: Both forms of the phosphate have had a more marked effect in their second year than in their first. Over the two years the ordinary Nauru has given better results than the specially fine-ground. Field 4: Contrary to the results obtained in Field 1, ordinary Nauru has not given as good results in its second year as it did in its first. The specially fine-ground phosphate has given a slightly better yield in its second year, but for the two years has not given quite so good results as the ordinary Nauru. Superphosphate, applied to a separate plot four months later than the main Nauru plots and at the same time as a Nauru-and-sulphur plot, has given results a good deal better than any of the others. The Nauru-and-sulphur plot shows a slightly better return than the Nauru alone; in the first year of its application it was not so good, but in the second year it shows a large increase.

Field 1, which was sown in a temporary-pasture mixture in 1921, has carried, besides the hay crop for which it was shut up for three months and a half, on the average 2$\frac{3}{4}$ sheep per acre for the year. Field 4, besides two hay crops for which it was shut up for five months, carried 1·6 sheep per acre. These two pastures have given quite fair grazing returns besides their hay crops, despite the facts that the grazing is not available at that period of the year when it would be greatest and the difficulty of getting sheep to adequately graze them at certain periods of the year.

The small permanent pasture near the old schoolhouse, which will in future be called Field 3A, was again obtained for a hay crop, and this was cut and weighed in December. The fertilizers used, their dates of application, and the green weights per acre are shown in the following table :—

Table 6.

Plot No.	Treatment (per Acre).	Date applied.	Hay-yield per Acre.		Total Weight per Acre, Two Years.
			1924–25.	1925–26.	
			Tons cwt.	Tons cwt.	Tons cwt.
1	Lime, 1 ton ; super, 2 cwt.	9/8/21 11/8/24	5 17	5 10	11 7
2	Bone-char, 4 cwt. .. Special Nauru, 4 cwt. ..	9/8/21 11/8/24	3 10	4 12	8 2
3	Walpole Island phosphate, 4 cwt. Ordinary Nauru, 2 cwt., special Nauru, 2 cwt.	9/8/21 11/8/24	4 10	4 8	8 18
4	Nauru, 4 cwt. .. ,, ,, ..	2/9/22 11/8/24	4 3	4 2	8 5
5	Control	..	2 1	1 2	3 3
6	Basic slag, 4 cwt. .. ,, ,, ..	14/7/21 11/8/24	4 7	2 4	6 11
7	Ordinary Nauru, 4 cwt. ,, ,,	14/7/21 11/8/24	3 19	1 16	5 15
8	Ephos, 4 cwt. .. ,, ,, ..	14/7/21 11/8/24	3 17	2 1	5 18

Although the different kinds of manure show a difference in weight, the greater difference was in the composition of the pasture constituents of the various plots. For instance, the basic-slag plot, although yielding just an average weight, was probably a better plot than some of the heavier yielders on account of its higher clover content. On the other hand, the yield from the control plot flatters it, as much of the material cut from it was of a very inferior nature, such as catsear, Yorkshire fog, and fiorin.

As forecasted in the final paragraph of last year's report, another piece of very old run-out permanent pasture of a little over 2 acres adjoining the Experimental Area was also secured for top-dressing trials. This will in future be known as Field 4A, and the objects of the experiments on both Fields 3A and 4A are to ascertain what improvement can be made on this type of poor pasture without breaking it up.

This area (4A) was laid off into twenty plots, every other one being left as a control, and the other ten were top-dressed during July as follows, the amounts given per acre being — Plot 2 : Lime, 1 ton. Plot 4 : Lime, ½ ton. Plot 6 : Lime, ½ ton ; super, 3 cwt. Plot 8 : Super, 3 cwt. Plot 10 : Basic super, 3 cwt. Plot 12 : Basic slag, 3 cwt. Plot 14 : Nauru, 3 cwt. Plot 16 : Super, 1½ cwt. ; blood-and-bone, 1½ cwt. Plot 18 : Super, 1½ cwt. ; blood-and-bone, 1½ cwt. ; sulphate of potash, 28 lb. Plot 20 : Super, 3 cwt. ; nitrate of soda (applied October), 1 cwt. A strip across all the plots was also top-dressed with kainit at 2 cwt. per acre.

This area was also cut for hay during December and weighings made from all the plots. The results of one year's treatment are hardly reliable enough for the actual results to be published. However, it was found that all the phosphatic manures showed a marked increase, and it was noticeable that the combination of lime and super gave better results than did either basic super, slag, or super alone. The best weight results were got from the combination of super and nitrate of soda, due in a large part to the excellent rejuvenation of the grasses of the rye-grass type on this plot. This was done, however, at the expense of the clovers, and this result will be gone into more fully before any definite statement is made as to the use of nitrate of soda as a top-dressing on this type of land, as the abnormal seasonal conditions may have had an undue influence.

As in the case of Field 3A, which has been top-dressed for a few years now, the improvement in the pasture is not so much in the increased weight obtained as in the proportion of the better types of grasses and clovers on the manured plots. On the control areas much of the material weighed was of an inferior nature, while on the manured plots there was a decided improvement in the quality of the hay.

The Lotus major sown in 1925 was such a poor strike that it was found necessary to plough up the ground, and the red-clover varieties referred to earlier were substituted. The brown-top sown at the same time has thickened out very nicely, and will be saved for a seed crop next year. Some small plots have also been sown with Danish strains of cocksfoot (two strains), brome-grass, meadow-fescue, Poa trivialis, Italian and perennial rye-grass, and yellow trefoil. If any of these show particular merit they will be saved for seed crops and larger areas sown.

CARRYING-CAPACITY OF AREA.

The sheep-carrying capacity of the whole Area for the year was $1\frac{3}{4}$ head per acre. Considering the amount of cropping done and the fact that it is not always possible to get suitable sheep at certain periods, this return may be considered quite satisfactory.

POSITION OF CONTAGIOUS MAMMITIS.

THE annual report of the Live-stock Division for 1925–26 states:—

"This disease has again been prevalent in dairying districts, although it would not appear to have been so troublesome as in the past. It is reported as having appeared to some extent in Otago and Southland, but mostly in the dairy herds of Southland. The Canterbury-West Coast district is comparatively free from the contagious form, but cases of the non-contagious form of mammitis have been noted. In all dairying districts in the North Island the disease is more or less prevalent, but, as stated, not to the same extent as in the past. Proprietary vaccines have been used fairly freely throughout the dairying districts as a prophylactic, and the results are being carefully watched, not with a desire to condemn, but in order that we might ascertain if they have any value as a prophylactic against this disease. The Department is unable, up to the present, to report in favour of this form of treatment. In some herds where inoculation had been practised the owners claimed an improvement as a result, but as in some cases adjoining owners had had similar experiences without the use of vaccine the claim is not substantiated. The present position, then, appears to be that generally immunity has not been conferred, and results are far from indicating any conclusive evidence of the efficacy of the particular vaccines in question."

TESTING OF PUREBRED DAIRY COWS.

APRIL–JULY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives particulars of performance of all cows which received certificates of record during the months of April, May, June, and July, 1926. This is, of course, a quiet period of the year in the operation of the C.O.R. system.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.	Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Holly Oak Queenie ..	L. A. McDonald, Levin ..	2 34	243·9	365	10,274·5	588·47
Alfalfa Heatherbell ..	Mrs. G. M. Harris, Wharepoa	2 80	248·5	365	6,853·9	421·07
Holly Oak Dainty Step	W. Oxenham, Uruti ..	1 353	240·5	365	6,274·3	416·49
Raithwaite Madge ..	Nicholas Bros., Mangatoki..	2 41	244·6	265	5,997·3	323·55
Golden Victress of Bull's	F. J. Watson, Bull's ..	1 351	240·5	313	6,113·2	312·73
Maple Farm Daffodil	J. H. Sherrard, Otaua ..	1 346	240·5	291	5,745·2	286·26
Duchess Double ..	A. J. Harris, Bombay ..	1 364	240·5	289	4,739·4	245·09
Senior Two-year-old.						
Palmdale Fancy ..	D. Kennedy, Morven ..	2 252	265·7	365	6,745·9	473·42
Sultan's Gem ..	A. J. Miller, Uruti ..	2 198	260·3	350	6,853·7	411·61
Lyndon Daisy ..	R. J. Johnston, Runciman..	2 328	273·3	264	6,423·4	362·24
Wichenford Anemone	F. I. Washbourn, Timaru ..	2 348	275·3	317	5,223·9	294·59
Distinction's Empress	Mrs. M. A. Wright, Pairere..	2 317	272·2	354	5,052·3	292·52
Three-year-old.						
Guiding Star ..	J. S. Rae, Taneatua ..	3 348	311·8	324	10,252·8	625·30
Mauriaena Lobelia ..	A. R. Clark, Hamilton ..	3 286	305·6	360	9,158·8	528·46
St. Aubin's Geranium	R. J. Johnston, Runciman..	3 178	294·8	365	9,225·5	503·50
Lyndon Juanita ..	R. J. Johnston, Runciman..	3 311	308·1	269	8,629·5	403·87
Cloverlea Laura ..	D. P. F. Malone, Kaponga..	3 362	313·2	250	7,827·9	421·98
Four-year-old.						
Woodlands Faith ..	H. C. Sampson, Hillsborough	4 56	319·1	365	10,439·5	688·11
Lynford Flower ..	D. O. Smith, Hastings ..	4 128	326·3	365	8,955·3	499·58
Rockview Heather ..	W. H. Fitness, Rehia ..	4 121	325·6	365	7,004·4	409·99
Mature.						
St. Aubin's Violet† ..	R. Wild, Drury	8 201	350·0	365	13,947·6	702·96
Oaklands Belle Mahone	F. W. Cornwall, Bell Block	5 349	350·0	266	8,722·7	583·34
Gleam's Eden ..	W. Robinson, Patumahoe ..	5 289	350·0	365	8,841·0	578·42
Neat Pilgrim ..	J. Robertson, Haumoana ..	5 198	350·0	323	8,072·2	419·63
	FRIESIANS.					
Junior Two-year-old.						
Maplewood Valdessa Pontiac†	John Court, Ltd., Auckland	2 28	243·3	365	18,001·5	666·19
Lichfield 21† ..	W. J. Polson, Fordell ..	2 29	243·4	284	8,104·4	347·79
Jewel Valdessa Pontiac†	John Court, Ltd., Auckland	2 35	244·0	317	8,414·6	300·69
Clothilde Segis Pietertje†	A. W. Chapman, Gordonton	1 364	240·5	295	6,980·8	246·63

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Rosevale Echo Sylvia Keyes*	North and Sons, Omimi ..	2 298	270·3	365	16,880·9	609·04
Grambling Fobes Johanna Grace†	John Court, Ltd., Auckland	2 209	261·4	365	15,243·6	556·74
Longbeach Netherland Queen 14th*	J. H. Grigg, Longbeach ..	2 313	271·8	365	13,872·1	482·35
Vrou Anna Van Racelands*	Smart and Sons, Tikorangi	2 327	273·2	359	14,692·2	477·29
Longbeach Transvaal Star II*	J. H. Grigg, Longbeach ..	2 280	268·5	365	11,722·0	405·46
Little Lassie Moonlight	C. Boyce, Tatuanui ..	2 272	267·7	365	11,355·0	375·14
Junior Three-year-old.						
Rosevale Kaatje Colantha Posch*	North and Sons, Omimi ..	3 94	286·4	365	14,623·7	506·59
Anawhata Colantha Johanna	B. F. Boucher, Kumeu ..	3 28	279·8	341	8,111·7	322·98
Senior Three-year-old.						
Friens Juliana ..	D. Dickie, Taita	3 232	300·2	278	10,348·0	378·31
Mature.						
Bloomfield Galatea Countess*	Bloomfield Farm Company, Wellington	5 214	350·0	365	18,965·2	709·45
Rosevale Katrina Posch*	North and Sons, Omimi ..	5 150	350·0	365	24,373·4	683·55
Longbeach Wallflower*	J. H. Grigg, Longbeach ..	7 42	350·0	365	18,511·1	658·74
Willowvale Galatea Segis*	Bloomfield Farm Company, Wellington	10 134	350·0	365	18,526·1	653·27
Eileen Girl† ..	A. W. Chapman, Gordonton	9 75	350·0	322	17,851·7	582·97
	MILKING SHORTHORNS.					
Three-year-old.						
Newstead Sally† ..	C. Roberts, Waitoa ..	3 27	279·7	300	8,978·2	361·77
	RED POLLS.					
Mature.						
Dominion Silken Lashes	Central Development Farm, Weraroa	5 347	350·0	320	7,896·1	401·09

Second-class Certificates.

	Jerseys.					
Junior Two-year-old.						
Mermaid's Lateefa ..	Mrs. G. M. Harris, Wharepoa	1 293	240·5	365	7,273·9	497·57
Senior Two-year-old.						
Kelvin Daisy ..	G. Buchanan, Paeroa ..	2 200	260·5	365	6,820·4	329·10
	Friesians.					
Junior Three-year-old.						
Rosevale Inka Lassie*	McDonald and Co., Dunedin	3 59	282·9	365	13,991·7	417·53

SEASONAL NOTES.

THE FARM.

CULTIVATION AND CROPS.

With September teams or tractors will be fully employed on a wide range of tillage-work connected with spring-sown crops. Land intended for the November and December rape crop should be deep-ploughed and allowed to lie fallow till ready for sowing. Land for potatoes and mangolds should be given a liberal dressing of any available well-rotted farmyard manure, and then deep-ploughed. Later it should be kept well stirred for sowing in October. Seed-beds for oats, peas, and oats and vetches for seed will be made on land already ploughed, and though sometimes the ground may need rather thorough working with cultivators, very often ordinary harrowing suffices.

Where spring sowing of permanent pasture is preferred the land should be well worked for seeding in October. The success of the strike with grass depends very much on the condition of the seed-bed. The last cultivations should not be deep, but rather in the nature of consolidating the soil, with just sufficient loose tilth on the surface to cover the seeds lightly. A number of failures occur through lack of consolidation, this being evidenced later by a good take in the wheel-marks of the machine and the foot-marks of the team, and poor germination over the remainder of the field. Many farmers, more especially in the South, sow grass with their spring oats. This practice, although not of the best, has something to commend it from an economy viewpoint. Care must be taken, however, to make a lighter sowing of the cereal with which the grass is sown. If convenient, the seeding with grass may be delayed until the nurse-crop of wheat, oats, or barley is sufficiently advanced to stand harrowing.

Suitable special crops for hay or ensilage are wheat or Algerian oats in conjunction with peas or tares. For spring use golden tares are usually preferred, but ordinary grey tares are quite suitable. In peas Early Minto and Grey Partridge may be recommended. For hay a sowing of 2 bushels of a cereal and 1 bushel of tares or peas per acre is a good mixture, but for ensilage a heavier and better crop will be got from 2 bushels of the cereal, 1 bushel of peas or tares, and ½ to 1 bushel of horse-beans. The beans help to hold the crop up. In localities where tares or peas do not grow very well it is advisable to increase the sowing of them to 1½ bushels per acre. A phosphatic manure should be used at 1 cwt. to 3 cwt. per acre, according to the condition of the land. All legumes like lime, and the addition of some should help them.

Where pea crops are grown for seed—Marlborough in particular—the wrinkle or field varieties should be sown within the first two weeks of September, preferably on land which has been limed during the winter and treated with superphosphate about a month before sowing-time. Ground previously infected with collar-rot should be avoided, as also seed from infested areas. It is all-essential that ground for

pea-growing should be well drained. Peas in soil containing stagnant water either fail to grow or rapidly succumb to collar-rot.

With the comparative decline of oat-growing, crop-rotation in Southland and south Otago is much less followed than formerly, and there is a tendency to grow several crops of turnips in succession on the same land. Owing to the prevalence of club-root this is not a desirable practice, and a forage crop of oats and vetches or oats and peas should alternate between any two crops of turnips.

SUBTERRANEAN CLOVER AND PASPALUM.

Early September is a suitable time for introducing subterranean clover into special paspalum hay paddocks where this is desired. At least ½ lb. of subterranean clover together with 1 lb. of white clover should be allowed per acre, mixed with manure, and the whole paddock top-dressed. This operation should follow after the field has been properly harrowed; and it is advisable to provide a chain or some other light harrow to assist in covering the seed, which is readily eaten by birds. The Cambridge roller is the ideal implement to use, however, as it presses the seed into the ground and a good strike is probable.

FERN-LAND MANAGEMENT.

Ploughing in September on broken fern land does much to injure the young rhizomes. Growth is commencing, and fern-shoots are then most vulnerable. Heavy tripod harrows should also be used during the coming month as soon as fronds appear in the grass-paddocks, for at this period grass is still backward and heavy stocking to crush young fern is hardly possible. The first crop of fronds is crushed and broken, the grass responds to the treatment from the harrows, and there will result a good growth of pasture, which can from then on be grazed heavily and the fern controlled practically by stocking alone.

LUCERNE.

Should soil conditions permit, the cleaning-up of lucerne stands can be carried out during the coming month. Growth which remained during winter should be very rapidly grazed off or cut, but, if grazed, care should be taken that the stand is not trodden and consolidated unduly, otherwise grass-growth will be encouraged. Immediately after removing the old growth, and provided the soil is dry enough, the stand should be given a few strokes with the cultivator to break up the surface and admit the air, which is so vital to the vigour and healthy growth of lucerne. A top-dressing may be given of 2 cwt. to 3 cwt. super, basic super, or slag per acre—preferably the super if the lime content of the soil is satisfactory.

Land intended for the sowing of lucerne later in the spring should now be prepared. A good sweet loam having an open subsoil is the best. Waterlogged soils are fatal; good drainage is essential. Soils deficient in lime require from 1 ton to 2 tons of carbonate of lime, to be applied during cultivation prior to seeding. Weeds must be killed by early ploughing and grubbing, the surface then being worked down to a fine firm seed-bed by harrowing every time a strike of weeds occurs. This consolidates the soil, but it may also be rolled before sowing to get a level surface.

—*Fields Division.*

THE ORCHARD.

CLEARING UP AFTER PRUNING.

At this period of the year the majority of growers will have finished or nearly completed the pruning of their trees. Where not completed, growers should push on as fast as possible so as to finish this work before the trees break into growth. All prunings and remnants of crops should be gathered up and burnt and not left lying about, thus eliminating a source from which disease may spread to the trees. A clean-up of all rubbish should also be made in the orchard. Many fungi survive the winter on such rubbish. Sanitation is one of the greatest protections a grower has against disease.

CULTIVATION AND COVER-CROPS.

The spring ploughing should be commenced as soon as the soil is in a suitable condition, and where possible every endeavour should be made to complete the work before the trees come into bloom. Break down the soil before it dries out and becomes hard, so as to conserve the soil-moisture as much as possible and to permit the roots to enter the broken soil and to establish themselves there for the purpose of obtaining food-supplies from the aerated soil during the spring and early summer months. When the deeper cultivation is delayed well on into the spring many of these rootlets and root-hairs are broken and rendered useless at the time the trees are greatly in need of them to provide food and moisture with which to develop the various parts. No pains should be spared to avoid giving normal and weak trees a check in their growth from the time the buds begin to swell until the crop has been harvested.

Green crops, if not already ploughed in, should be turned in as soon as the ground is dry enough to permit of it being worked. In the lighter soils, in order to hasten the decomposition of the material turned in, the ploughed surface may be rolled flat.

MANURING.

In practically all orchards growers will find it to their advantage to apply a fertilizer to the soil, as bearing trees take a good deal of food from the soil annually. Our most successful orchardists fertilize their soil. From 5 cwt. to 12 cwt. per acre of a complete fertilizer should be applied according to the conditions prevailing in the orchard. The proportion of the ingredients of the fertilizer should be one part sulphate of ammonia, four parts 44/46 per cent. superphosphate, and one part 30 per cent. potash salts. Nitrate of soda may be used in place of sulphate of ammonia; it should not be combined with the superphosphate, but applied separately at a later date. In many situations blood-and-bone may be preferable, where a quick-acting fertilizer is not required, to either of the previously mentioned nitrogenous fertilizers. The wood-ashes saved from the burnt prunings and rubbish should be combined with the fertilizer and evenly broadcasted throughout the orchard. The material should be harrowed into the

ground right away. There are orchards where the application of ½ ton of lime per acre in addition to the fertilizer would give beneficial results.

PLANTING.

The planting of fruit-trees should be completed with as little delay as possible. It has been observed where trees have been planted very late and a dry spring has been experienced that they have not made the same good growth as earlier planted trees.

GRAFTING.

According to the locality and season, grafting may be safely done in most districts from the second week in September up to the middle of October. The work may be commenced as soon as the trees to be worked start into growth and the sap is rising freely in the stock. The scion should be kept dormant, as the best results are obtained from this practice. Bark grafting is the usual method adopted on trees which are being reworked. The scion to be used should be at least the thickness of a lead-pencil, and should contain three developed wood-buds. To prepare, cut the lower part of the scion to a thin wedge, while one of the three buds is preserved towards the base. Carefully pare the thin outer bark of one side of the wedge to ensure the cambium layer of the scion coming in close contact with that of the unlifted cut bark of the stock. Slit the bark of the stock to nearly the length the wedge of the scion is to enter. One side of the bark is lifted slightly, and the scion then pressed in against the unlifted cut surface of the bark. Bind firmly with raffia and carefully cover with grafting-wax to exclude air and rain. From two to four grafts should be inserted in each limb according to its size.

SPRAYING.

As we are now entering upon an important period in the control of orchard pests and diseases it is necessary that the trees should be kept growing as vigorously as is consistent with maturing good crops of high-grade fruit, and that the spraying programme should be carefully considered. Every effort should be made to control and reduce pests and diseases to a minimum, as it is in the best interests of every fruitgrower that the trees should be kept clean and healthy, and this can best be accomplished by (1) good materials properly prepared, (2) thorough application at correct times, and (3) early application of specifics which have been recommended.

Thoroughness in spraying is essential and important. Even though spraying is almost universal nowadays there are very few fruitgrowers who carry out this first essential in producing clean fruit in a thorough manner. Thorough spraying means that every leaf and fruit must be covered all over with a thin film of spray. To do thorough spraying the operator must move about and around the trees and spray the inside as well as the outside, and on the top as well as on the underside of the leaves, branches, and limbs. To obtain the best results and avoid loss sprays must be put on at the right time or times, because if applied at other times (1) they may have no beneficial effect, and (2) they may cause injury.

Early application in spraying is strongly recommended as a preventive measure for the control of pests and diseases. In this respect (1) poisons for chewing-insects and fungicides for fungi must be on the foliage and fruit before the pest or disease arrives if they are to do any good; (2) contact sprays for sucking-insects kill only when they come in contact with these insects, and sprays must be applied when they are present.

The pump should be thoroughly washed out after use and before another specific is put into it.

When to spray and what to spray with are the questions of vital importance asked by practically every fruitgrower. The following calendar will serve as a guide :—

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Stone-fruits.		
San Jose scale. Red mite. Black and green aphis.	(1.) Red-oil emulsion, 1 in 15	(1.) Dormant period.	
	(2.) Lime-sulphur, 1 in 15.	(2.) Bud-movement.	
	(3.) Lime-sulphur, 1 in 50.	(3.) Early pink or pre-blossom.	
	(4.) Lime-sulphur, 1 in 120, or self-boiled lime-sulphur, 8–8–50.	(4.) Petal-fall.	
Bladder-plum. Brown-rot. Leaf-curl. Leaf-rust. Die-back. Shot-hole.	(1.) Bordeaux mixture, 8–6–40, or lime-sulphur, 1 in 15.	(1.) Bud-movement, towards mid-August.	Prune out and burn all dead twigs and spurs at winter pruning. Gather and burn all mummies, together with portion of spurs to which they are attached. Apricot-trees should not be sprayed with lime-sulphur spray.
	(2.) Lime-sulphur, 1 in 50.	(2.) Early pink or pre-blossom.	
	(3.) Lime-sulphur, 1 in 120, or self-boiled lime-sulphur, 8–8–50.	(3.) Petal-fall.	
	Pip-fruits.		
Red mite. Pear-leaf blister mite. Woolly aphis. Scales.	(1.) Red oil, 1 in 12 to 15.	(1.) Bud-movement, towards end August.	A number of commerical growers are using lime-sulphur, 1 in 12 to 15, at bud-movement, followed by oil, 1 in 20, when the primary buds are showing green-tip, with good results for control of red mite.
	(2.) Lime-sulphur, 1 in 10.	(2.) Green-tip.	
	(3.) Lime-sulphur, 1 in 35.	(3.) Open cluster or pre-blossom.	
	(4.) Lime-sulphur, 1 in 100, or nicotine sulphate, 1 in 800, and soap.	(4.) Petal-fall.	
Apple-leaf hopper.	(1.) Lime-sulphur, 1 in 35.	(1.) Open cluster.	Each application should be made before winged stage of insect makes its appearance.
	(2.) Nicotine sulphate, 1 in 800, and soap.	(2.) Petal-fall.	

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Pip-fruits—continued.		
Black-spot of apple.	(1.) Bordeaux mixture, 6–4–50, or lime-sulphur, 1 in 10.	(1.) Green-tip.	
	(2.) Lime-sulphur, 1 in 35.	(2.) Open cluster.*	
	(3.) Lime-sulphur, 1 in 120, plus 8 lb. to 10 lb. precipitated sulphur.	(3.) Petal-fall.*	
	(4.) Lime-sulphur, 1 in 120, plus 8 lb. to 10 lb. precipitated sulphur.	(4.) Two weeks later.*	
Powdery mildew.	(1.) Lime-sulphur, 1 in 10.	(1.) Green-tip.	Prune off and burn infected portions of shoots, twigs, and spurs at pruning-time, and later as they appear.
	(2.) Lime-sulphur, 1 in 35.	(2.) Open cluster.*	
	(3.) Precipitated sulphur, 10 lb. to 12 lb. per 100 gallons.	(3.) Petal-fall.*	
	(4.) Precipitated sulphur, 10 lb. to 12 lb. per 100 gallons.	(4.) Two weeks later.*	
Black-spot of pear	(1.) Bordeaux mixture, 6–4–50.	(1.) Green-tip.	Prune off and burn all infected shoots and twigs. It is advisable after, on Winter Cole, P. Barry, and Josephine varieties, to apply lime-sulphur, 1 in 35, at open cluster, and subsequently lime sulphur, 1 in 100.
	(2.) Bordeaux mixture, 3–4–50.	(2.) Open cluster.*	
	(3.) Bordeaux mixture, 3–4–50.	(3.) Petal-fall.*	
	(4.) Bordeaux mixture, 3–4–50.	(4.) Two weeks later.*	

* Very important applications in programme of control measures for these diseases.

—W. K. Dallas, Orchard Instructor, Dunedin.

CITRUS-CULTURE.

Planting.—Where new plantations are being set out or replacements are required an effort should be made to complete the work by early September.

Varieties.—Dominant features of the best known varieties are as follows:—

Lisbon: The best known and most largely grown variety. Thorny trees of very strong growth; reliable fruiter in successive crops; fruit rather rough, with prominent nipple.

Eureka: The best summer-fruiting variety; widely grown. Trees thornless, robust growth, of good even habit; reliable cropper of well-shaped fruits—rather round, with even slope to nipple.

Messina: A variety largely imported into the Dominion. As grown in New Zealand identical with Lisbon in general habit—growth, foliage, thorns, and fruit.

Villa Franca: Tree almost thornless; generally light growth; a heavy summer cropper of well-shaped fruits.

Sicily: Rather robust growth; tree practically thornless; successive cropper of well-shaped fruits.

Mayer: Of recent introduction. Reported to be the hardiest variety grown; thorny trees; a precocious and heavy cropper of refined, well-shaped fruits; successive cropper. Juice decidedly better than usual lemon flavour.

Manures.—For young trees—say, up to five years—2 lb. blood-and-bone and ¼ lb. sulphate of potash may be applied with advantage now, and ¼ lb. nitrate of soda at two periods later in the growing season. For bearing trees 4 lb. blood-and-bone, 1 lb. superphosphate, and ½ lb. sulphate of potash is a good dressing. These fertilizers should be evenly distributed over the whole area rather than immediately near the trees, and worked in by cultivation.

Cultivation.—During late August or early September spring cultivation should be done. This includes ploughing to turn in green crops which may have been grown for that purpose, or weeds, which are best disposed of at this period by being turned under. Though the soil may be in a clean condition, ploughing at this time of the year is beneficial, breaking up the compacted state of the soil and permitting aeration. In most citrus-groves there is an area near the trunks of the trees which cannot be ploughed or cultivated with horse implements. In order that this area may be dealt with by the hoe later, spade-work is necessary at the present time. If the land is not dug over now fibrous roots become so dense later as to make it impossible to more than scratch the surface without damaging the roots. On the other hand, digging the soil now, when fibrous roots are least necessary, a condition is secured which allows several inches of soil to be kept in good tilth during the summer. When cultivating to work in a heavy dressing of animal manures it is better that the manure should be spread along the furrows as ploughing is being done.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

BROODING-POINTS.

No hard-and-fast rules can be laid down in regard to handling brooder chicks. If success is to be achieved the individual concerned must study out things for himself. In the first place, he must see that the parent birds are fed and managed in such a way that the chicks possess outstanding health and vigour when placed in the brooder. Next in importance is that he shall be a close observer and anticipate the requirements of the chicks from day to day. There must be no such thing as "near enough" in the chain of management. Everything

must be done at a regular time and in a thorough manner. The great aim should be to make the chicks comfortable at all times, as only in this condition can perfect health be maintained.

It is especially necessary to take climatic changes into account, and to amend the methods of management accordingly. It should be remembered that if the slightest mistake is made, especially during the early stages, it cannot later be rectified, and trouble is almost sure to follow. For example, if the chicks become chilled, bowel trouble soon appears. Once this disorder sets in little or nothing can be done, and it will generally pay in the long-run to destroy the whole lot of chicks rather than try to doctor them. It is a common error to conclude that because the chicks look well on the day following a cold night, or where an incorrect degree of heat has been applied, they have not been affected. The chicks will have become affected, but will not show the result for two or three days. Where chicks show no inclination to leave the brooder it is usually a sure danger-signal that they have been chilled and that heavy mortality may be expected.

Nearly all troubles in connection with rearing brooder chicks are due to neglect of some essential detail. Failure to provide the correct degree of temperature and sufficient fresh air are among the most common. The desired heat should be maintained, but it must be a healthy heat, which, while providing the right degree of warmth, does not force the delicate chick to breath vitiated air. The mother hen and her brood provide a striking lesson in this respect. From her body-heat the chicks are provided with the desired temperature, while at the same time they are given an opportunity to breath the outside atmosphere. Most brooder troubles can be overcome by studying nature, but how few poultry-keepers there are who realize this!

While chill and its evil effects are the most common cause of mortality in the artificial rearing of chicks, it should not be inferred that a temperature falling below the desired degree is always the cause of the trouble. There are other ways in which chicks become chilled. Too high a temperature is just as fatal as too low a one. It not only lowers the vitality of the chicks, but in addition it makes them susceptible to chill when leaving the brooder and coming into contact with the ordinary temperature in the runs. Some brooders are constructed in such a way that the chicks cannot get away from the heat when it is excessive. This frequently happens on a hot night, and is undoubtedly the most common cause of chill. Brooders should be arranged in such a way that the chicks will be encouraged to settle down at night slightly away from the main source of heat when normal conditions prevail. Then in the event of a cold night following a hot one, or *vice versa*, the chicks are afforded an opportunity to move to and from the heat as instinct demands. When chicks are enjoying a comfortable degree of warmth they will spread over the floor of the brooder. On the other hand, when they are cold they will huddle together, and this brings on a sweated condition, which proves fatal to them in most cases.

Another common cause of chill lies in giving the chicks too much freedom for the first few days. They should be kept in the brooder for the first three days, having a division in it where fresh air and light may be obtained. Then they should be given a short run for the next day or two, increased by degrees in accordance with the prevailing

weather conditions. If baby chicks are given a lengthy run they are apt to lose their bearings, and thus feeling the change of temperature will huddle together and become chilled. The mother hen and her brood afford another valuable lesson in this respect. At first the hen allows the chicks only a very few minutes to feed and exercise, when she calls them under her body for the purpose of warming them. As they grow older, and providing the weather is favourable, the time given to exercise is extended, but never, even on the hottest days, does she neglect to give them a warm-up when required.

FEEDING OF CHICKS.

While proper temperature, ventilation, and strict attention to cleanliness are the chief factors in rearing brooder chicks, the matter of providing the right class of food must not be overlooked. There are numerous different mixtures that will give equal results. The main point is to feed sound, wholesome food. Dry, coarse oatmeal is ideal for the first few meals. This may be followed by a reliable brand of chick-raiser. Even these mixtures are apt to deteriorate through age or when kept in a damp place, and where they are used care should be taken that the material smells and tastes sweet before being fed. Chicks do not require food for twenty-four to thirty-six hours after they are hatched. Even then two meals are sufficient for the first feeding-day. During the early stages it is a good plan to slightly moisten the broken grain food. This will cause it to swell and become more easily assimilated than is the case with any hard grains.

Few poultry-keepers realize the value of dry, coarse bran for young chicks. Right from the start it should be in reach of the chicks to pick at. In feeding dry bran, especially to baby chicks, it is necessary to devise some means that will enable them to consume the food without wasting it. A simple method of doing this is to place the bran in a shallow box, say, about 3 in. high, 8 in. wide, and a length to suit requirements. Fill the box to, say, 1 in. from the top with bran, and place on top of the latter a piece of ½-in.-mesh wire netting. This should be cut to a size which will allow it to fit loosely inside the box, and thus fall by degrees as the chicks consume the food. In this way the food is within easy reach of them, and the wire netting prevents them from scratching it out and becoming soiled and consequently wasted. A strong point in feeding dry bran is that it does not become sour as when included in a wet mash. The latter should never be left in the run; as soon as the chicks cease to eat it freely it should be removed.

An important point in rearing brooder chicks is to keep them well exercised. The best way of inducing this is to feed some chick-food in the litter and make them scratch for it. Grit, charcoal, and clean water should be within easy reach right from the first.

Where boiled meat is not available it is a good plan to have a good grade of meat-meal in a separate receptacle for the chicks to pick at. Many poultry-keepers hold the opinion that the supplying of meat or its substitutes to chicks during the brooder stage tends to premature maturity, but this is not necessarily the case. Where the danger lies is by providing a too-liberal meat diet after the birds have passed the brooder stage. The object at this time should be to keep the birds steadily growing and bringing them to a desired size and age before commencing to lay. It is not generally known that the lack of animal

food is a common cause of chicks acquiring the habit of toe-picking and other cannibalistic habits. As a preventive against these troubles the chicks should be regularly provided with animal food. Better by far not to feed it at all than at odd periods. What the chicks never have they never miss, but if once they discover the taste of meat they crave for more, which is evidenced by the fact of their commencing to eat each other.

On no account neglect to give the chicks all the green food they will eat. There is nothing better than finely cut succulent grass, lucerne, or clover. Never feed these materials when they have reached a fibrous stage, as in this condition crop and gizzard compaction are apt to result. Lettuce, watercress, or almost any succulent green material is suitable for the purpose.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

BREEDING.

NORMALLY at this season of the year there are large patches of brood in the hives. A further examination may be carried out where the beekeeper was in doubt in the preceding month as to the hive being queenless or not. The absence of brood at this season will denote a poor queen or that the hive is queenless. In either case it is advisable to unite with another hive. This should be done immediately, as a queenless hive stands in great danger of being robbed by other bees in the apiary. A ready method of uniting is by placing the weak colony over a strong one on the stand of the latter, with a sheet of newspaper between the two hive-bodies. They may be examined after a couple of days to see if things are going well, and if the paper is not bitten through it should be torn in several places. In another day or two the united colonies will be working peaceably. In the case of the weaker colony it is wise to kill the queen before uniting.

At this examination the beekeeper must keep a strict watch for symptoms of disease. If foul-brood is discovered in a mild form the colony should be marked for treatment later in the season. Should the colony be badly affected, however, it is advisable to sulphur the bees and destroy the combs. Care should be taken to remove the hive to a place of safety until it can be properly cleansed.

OVERHAULING THE HIVES.

In August a great deal of the preliminary seasonal work of the apiary may be done. Each hive should receive a good coat of paint. This will help to preserve the timber, besides giving the hives a neat appearance. The bottom-boards should be scraped clean. During the winter months there is usually an accumulation of cappings, pollen, and dead bees, and, if left, this becomes a harbour for woodlice, which are very objectionable. A simple plan is to provide a spare bottom-board. Lift the hive on to the spare one, scrape the old board, and replace the hive. Remove all top boxes, and make the bees snug and warm for brood-rearing. Clean all weeds and long grass from round the hive. Long grass keeps the hives and bottom-boards damp, and acts as a harbour for insects.

CLEANSING HIVES AND FRAMES.

The beekeeper should not fail to cleanse all hives and frames that have been in contact with diseased colonies. This work may be undertaken now, and the hives and frames prepared for future use. Where there is only a small number of frames to be cleansed it is hardly worth while to attempt to save them. However, if much material has to be treated the saving effected will more than pay the beekeeper for his time and labour. There are several methods for treating hives and material, but perhaps the simplest and most effective is by the use of boiling water and caustic soda. Many beekeepers recommend the use of a painter's blow-lamp, but this is not always handy, besides which the charring of the hives is an advertisement for all time that they once contained diseased bees.

The most suitable vessel for cleaning frames is an ordinary washing-boiler. To every 8 gallons of water add 1 lb. of caustic soda, and allow to boil. The frames may be tied in bundles of six and immersed in the liquid. The caustic soda attacks the propolis and wax, and this immediately floats on top of the water. Three to five minutes' immersion will serve to cleanse each bundle of frames. Skim the refuse from the top of the water frequently, and as the solution weakens add more soda. Stack the frames in supers, and place in the sun to dry. The hive-bodies and bottom-boards may be cleansed by means of a swab. Immerse the swab in the boiling water and carefully wash the inside of the hives. Care must be taken when using caustic soda, as it is liable to burn the hands.

ARRANGEMENT OF HIVES.

There is no set system of arranging hives, and they may be placed according to the preference of the beekeeper. The entrances should all face the north if possible; but on no account should they face south or in a westerly direction if this can be avoided, as the cold driving winds from these quarters militate against successful brood-rearing. It is important that the hives be so placed that the beekeeper need not pass in front of the entrances when carrying on operations. Do not place the hives close together in long rows, as there is a danger of the queens entering the wrong hives and being destroyed; moreover, the plan will militate against successful manipulation, as the closely adjacent colonies will be disturbed whenever one is opened.

A good arrangement of the hives is to set them out in pairs, with at least 3 ft. between each pair. This affords the beekeeper plenty of operating room. The two hives comprising the pair may stand within a few inches of each other, leaving clearance for the roofs. The space between each two rows should be at least 6 ft., but more can be given if space is not a consideration. In order to preserve the bottom-boards the hives should be raised a few inches off the ground. Concrete blocks or old bricks make excellent supports for the hive. Each hive should have a slight cant, so that the entrance is about 1 in. lower than the back. This will prevent water from collecting on the bottom-board.

USE OF COMB-FOUNDATION.

Section 6 of the Apiaries Act provides that "In any case in which it is found by an Inspector that the bee-combs in any hive cannot

without cutting be separately and readily removed from the hives for examination, he may direct the beekeeper to transfer the bees to an approved hive within a specified time." This makes it very clear that the beekeeper must exercise some care to get the bees to draw down straight combs. It often happens that bees are put into hives fitted with frames which contain no foundation. Having done this the beekeeper is satisfied that he has complied with the Act, but such is not the case. It invariably happens that the bees cross-draw the combs, and the hive is in the same condition as if the bees had been put into a common box. The bees build the combs to suit themselves, and instead of drawing them straight down, as in well-built frames, they fill the hives from side to side with irregular pieces of comb and render the manipulation of the frames impossible without breaking them to pieces.

By the use of foundation beekeepers can obviate this trouble and induce the bees to draw down straight combs; thus examination for disease can proceed without hindrance. By the introduction of comb-foundation a great step was made in modern apiculture, and perhaps, next to the invention of the frame hive, it marked the most important development. The judicious use of comb-foundation gives the apiarist complete control over brood-rearing, and this factor is perhaps as important as that of good, straight combs. It usually happens that if bees are provided with only strips of foundation, or put into common boxes, they build a large quantity of drone comb, which will be subsequently utilized for breeding drones; thus one of the principal objects of the use of foundation is defeated. The presence of a few drones in the hive is imperative, as they are required for impregnating the young queens; but in practice it is usually found that the bees will contrive to breed a sufficient number for that purpose although full use be made of foundation.

Drones, as beekeepers know to their sorrow, are non-producers, and it is generally conceded that they do no work in the hive, but, on the other hand, consume large quantities of food gathered by the workers, and their presence in large numbers will militate against profitable beekeeping. Traps may be used for the purpose of catching the drones, but this method is not in general use, save perhaps by beekeepers who make a practice of rearing queens, and then they are applied for the purpose of trapping drones from undesirable queens. In practice it is by far the best policy to use full sheets of foundation; but in any case the beekeeper who neglects its use altogether will be up against the problem of having to transfer his bees at a later date.

ROBBING.

A strict watch should be kept for robbing. This is most likely to occur when feeding has to be undertaken, and once started it is about the hardest thing to cure. Feed only in the evening, so that the excitement created by the supply of warm syrup will have died down before morning. Keep the entrances to all hives contracted, and see that there are no cracks through which a robber could possibly enter. Perhaps the main cause of robbing, however, is the presence in the apiary of queenless or weak colonies. If the bees once discover a queenless hive there will be no peace until the source of trouble is removed. The inmates of such a hive will not defend their stores as will bees in a

normal condition, and unless the colony is united with another it will tend to demoralize the rest of the apiary, until none but strong colonies will be safe from the depredations of the robbers.

Where a weak colony is in danger of being attacked, and where the beekeeper is satisfied that it is worth saving—that is, if he considers the queen good enough to build up a strong colony by the time the main honey-flow sets in—his best plan is to pile wet grass on the alighting-board and well up above the entrance, keeping the grass wet for a day or two, and painting any cracks in the hive with kerosene or carbolic solution. This treatment will soon settle the robbers and restore peace in the bee-yard. However, the best thing to do with weak colonies is to unite them without delay with stronger hives. Like most other troubles, though, prevention is the best thing when dealing with robbers. Do not spill any syrup near the hive, do not leave any combs lying about, and do not have any weak colonies, and you will not be troubled with robbing.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

TOBACCO.

As a provision against contingencies it is customary to sow one or two extra beds of tobacco-seed, and this may be done now. There is a general tendency to make these beds rather small for the number of plants to be raised. This is a serious mistake, as the crowded plants are soft and drawn, and make a slow recovery when planted in the field, if they recover at all. Too often a number of blanks are the result, and when these are replanted the plant that is finally established is backward and is unsatisfactory, owing to being a stage or two behind the majority in growth and ripening. For satisfactory spacing of young plants in the seed-bed nine or ten square yards are required to produce sufficient plants for 1 acre in the field. The beds should be kept moist, but not wet, until the plants are about half-grown, when hardening will be assisted if watering is done more sparingly. About a month before lifting them they may be watered with liquid manure if considered desirable, dissolving 6 oz. nitrate of soda or 8 oz. sulphate of potash in 50 gallons of water. Such applications may be made fortnightly. To produce strong, well-developed plants for putting out in the field the beds must be kept weeded and the plants well thinned out.

The land in which the plants are to be set out should now receive careful preparation. Plough in all vegetation, and give it ample time to decay. Frequent cultivation should be given later to destroy seedling weeds, grubs, and cutworms, working in a dressing of lime where the land is inclined to be sour.

VEGETABLE-GROWING.

Weeds as well as crops will now be making rapid growth, and, as they are not compatible, advantage should be taken of all bright, dry weather to put the hoes through the crops to destroy the weeds before they reach any considerable size. This cultivation should be shallow,

as most of these plants are shallow-rooting and easily injured. Such seedling crops as require thinning should be given this attention as soon as the second pair of leaves appear.

Main crops of carrots, beet, potatoes, peas, celery, leeks, and salads may now be sown. Much work will be avoided if the sowing is done with discretion; sow thinly, and so save seed and avoid the tedious labour of thinning seedlings.

Where such permanent crops as asparagus and rhubarb are to be planted the land should now be clean, deeply worked, and in good heart. In such cases planting may proceed without further delay. Commercial plantings of asparagus are now set 18 in. apart, with 3 ft. between the rows. Land for this purpose that is heavy and inclined to form a surface crust is much improved by working in a good dressing of sand.

GLASSHOUSE WORK.

Tomatoes planted out under glass will now be established, and should be kept warm and watered with care. Water them only in the trenches in which they are set, and maintain rather a dry atmosphere.

Half-hardy plants for setting out next month, such as tomatoes, egg-plants, peppers, and Cape gooseberries, should be grown on steadily, with sufficient air to make sturdy plants. Where trouble is experienced through the plants "damping off"—*i.e.*, the base of the stem near the soil rotting off through the attack of a fungus parasite—the Cheshunt Compound may be used. The soil may be watered with it after sowing and covering the seeds. Young plants may be watered with it, or the boxes of soil, before pricking out, may be sterilized by watering the infected soil with the solution, after which planting may be proceeded with as soon as the soil is sufficiently dry.

This compound is composed of 2 oz. copper sulphate and 11 oz. ammonium carbonate reduced to a fine powder and thoroughly mixed. The mixture may be stored in a dry state in an airtight receptacle, without which it gradually loses ammonia and becomes less potent. The dry mixture should be stored for twenty-four hours in a tightly corked glass or stone jar before using. The solution is then prepared by dissolving 1 oz. in a little hot water and making up to 2 gallons with water. The solution must not be put in vessels of iron, tin, or zinc, as it would corrode them and lose its strength. Only just as much as is required for immediate use should be prepared. Plants already attacked will receive no benefit from the solution, but the causal organisms will be destroyed.

PLANTING OF EVERGREENS.

The present is a most suitable time for planting evergreens. Where black passions are to be grown they may be planted now in good, well-prepared ground with every prospect of success. The usual method is to plant them 12 ft. apart and train them to one stem to stakes about 5 ft. high, stopping the lateral growths as soon as a few leaves have formed. Fencing-posts erected at intervals of 24 ft., with a couple of No. 8 wires strained along the top, carry the vines after reaching the height of 5 ft. Make the rows 10 ft. apart, and let them run north and south. In suitable localities these vines should return payable crops for five or six years.

INSECT PESTS.

Many kinds of insects and their larvæ are in oversupply among the crops at this season of the year. The heavy losses incurred have drawn attention to this problem and resulted in some improvement in the methods of dealing with cutworms, slaters, slugs, &c. Bordeaux sprays or nitrate of soda are a certain protection for the plants, and where these can be used for a dual purpose there need be no anxiety. Powdered alum broadcasted weekly has been used during the past season by some growers of young plants with entirely satisfactory results—for the grower; it effectively protects the plants from slugs and snails. For larger areas some economy can be effected by mixing one part of powdered alum to two parts of slaked lime and broadcasting it at the rate of ½ cwt. per acre.

A cheap bait for all the insects mentioned, and recommended on the best authority, consists of 25 lb. bran and 1 . arsenate-of-lead powder. Mix them well in a dry state. Add water, and mix thoroughly till the whole mass is damp, but not so wet that the flakes stick together. Let it stand for a few hours, then broadcast by hand about ½ cwt. per acre. For small areas mix one teaspoonful of arsenate-of-lead powder and two teaspoonfuls of cornflower, and cut up carrots into cubes to make 1 quart. Place the ingredients in a 2-quart jar and cover. Shake them together until they are thoroughly mixed, when they may be distributed among the plants to be protected. As these insects are night feeders, treatment is best given of an evening to young plants requiring the protection.

—*W. C. Hyde, Horticulturist.*

EGGS AND EGG-PULP IN COLD STORAGE.

THE following statistics have been issued by the Government Statistician :—

		At 30th June, 1926.			At 31st March, 1926.		
		North Island.	South Island.	Dominion.	North Island.	South Island.	Dominion.
Eggs in shell	.. doz.	930	2,925	3,855	15,990	31,993	47,983
Egg-pulp	.. lb.	212,462	182,080	394,542	458,820	327,747	786,567
Frozen whites	.. lb.	246	476	722	432	910	1,342
Yolks ..	.. lb.	..	..	..	..	..	..

Interim Returns of Live-stock as at 31st January, 1926, issued by the Government Statistician include the following, the figures added in parentheses being the final numbers for 1925: Dairy cows, 1,279,860 (1,303,129); total cattle (including dairy cows), 3,412,612 (3,470,476); pigs, 463,522 (432,778); horses, 304,254 (309,123). The enumeration excludes boroughs. Interim returns of sheep were published last month.

The Kea.—The subsidy of 5s. per beak paid by the Department of Agriculture for the destruction of keas during the year ended 31st March, 1926, totalled £974 5s., equal to 3,897 birds.

WEATHER RECORDS: JULY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

JULY, the midwinter month in New Zealand, was remarkable for three storms, particularly affecting the North Island. A cyclone developing in the North on the 10th had its greatest intensity on the following day northward of Kawhia and Poverty Bay, although, owing to its influence, rains were experienced and snow fell on high levels farther south. This storm ruled from the 10th to the 13th, and was followed almost immediately by a westerly depression which caused rains along the west coast and gales about Taranaki, Waikato, and other parts. Between the 23rd and 28th another westerly depression, with two centres, caused gales and heavy rains, particularly in the Manawatu, Wanganui, and Taranaki districts, and severe floods caused considerable damage in these parts.

The whole of the South Island, with the exception of Queenstown, experienced much less rain than usual. Many parts of the North Island also had rainfall considerably below their July average.

There were a number of frosts in the east-coast districts of both Islands, but the weather on the whole was dry and milder than usual.

RAINFALL FOR JULY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	3·50	11	1·14	5·96
Russell	5·23	11	2·21	4·26
Whangarei	9·98	13	5·09	8·33
Auckland	2·81	17	1·16	4·98
Hamilton	3·40	18	1·04	5·24
Kawhia	4·26	17	0·90	6·86
New Plymouth	6·51	16	1·76	6·28
Riversdale, Inglewood	11·24	17	3·94	9·93
Whangamomona	8·45	7	3·40	7·68
Tairua	5·36	8	1·36	5·15
Tauranga	4·41	11	1·39	4·86
Maraehako Station, Opotiki ..	3·34	10	1·38	4·45
Gisborne	5·46	15	2·03	5·14
Taupo	3·63	11	1·57	4·21
Napier	2·28	12	0·69	3·90
Maraekakaho Station, Hastings ..	3·03	10	1·14	3·65
Taihape	3·47	15	0·96	3·15
Masterton	2·14	17	0·39	4·31
Patea	5·51	11	2·13	4·10
Wanganui	4·70	4	1·95	3·63
Foxton	6·68	10	..	3·26
Wellington	2·89	17	0·57	5·59
South Island.				
Westport	3·47	12	1 38	6·99
Greymouth	4·37	15	0·75	8·43
Hokitika	4·76	13	1·05	9·08
Ross	6·20	9	1·64	9·94
Arthur's Pass	10·55	11	2·93	12·53
Okuru, Westland	9·57	13	1·96	12·03
Collingwood	7·23	11	1·92	9·65
Nelson	1·09	8	0·60	3·49
Spring Creek, Blenheim ..	0·95	7	0·50	3·93
Tophouse	3·06	7	0·83	5·65

RAINFALL FOR JULY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Hanmer Springs	3·56	15	0·78	4·65
Highfield, Waiau	2·38	6	0·92	3·63
Gore Bay	1·44	9	0·53	3·31
Christchurch	1·16	8	0·35	2·76
Timaru	1·14	8	0·58	1·93
Lambrook Station, Fairlie ..	1·14	5	0·64	2·72
Benmore Station, Clearburn ..	1·66	10	0·65	1·74
Oamaru	0·55	6	0·28	1·74
Queenstown	2·21	6	0·86	2·01
Clyde	0·16	6	0·05	0·94
Dunedin	1·24	10	0·66	3·01
Wendon	0·65	5	0·19	1·98
Gore	0·96	13	0·35	1·96
Invercargill	2·24	15	0·40	3·28
Puysegur Point	6·18	18	0·94	6·18

—*D. C. Bates, Director.*

VARIETIES OF APPLES EXPORTED IN 1926 SEASON.

THE following particulars of the varieties of apples exported from New Zealand to Britain, South America, and Hawaii in the past season have been compiled from Orchard Instructors' reports, the figures representing the number of 1-bushel cases shipped :—

Sturmer, 179,968 ; Jonathan, 170,176 ; Delicious, 114,296 ; Dunn's, 69,659 ; Cox's Orange, 49,182 ; Statesman, 18,963 ; Dougherty, 18,333 ; Cleopatra, 15,782 ; London Pippin, 13,775 ; Worcester Pearmain, 7,769 ; Rome Beauty, 5,910 ; Gravenstein, 5,621 ; Lord Wolseley, 5,380 ; Rokewood, 4,818 ; Stayman Winesap, 3,903 ; Newtown Pippin, 3,806 ; Ballarat, 2,588 ; Scarlet Nonpareil, 2,438 ; Spitzenberg, 2,224 ; Salome, 2,133 ; Adams Pearmain, 1,931 ; King David, 1,898 ; Tasma, 1,824 ; Stark, 1,813 ; Willie Sharp, 1,552 ; Shorland Queen, 1,440 ; Edward Lippiatt, 1,288 ; Yates, 1,284 ; Premier, 1,103 ; Grannie Smith, 1,004 ; Brownlee's Russet, 867 ; Ribston Pippin, 835 ; Golden Pippin, 823 ; Parlin's Beauty, 726 ; Pioneer, 680 ; Alfriston, 649 ; Hoover, 637 ; Celo, 464 ; Boston Russet, 436 ; Swaar, 373 ; Horn, 337 ; Golden Russet, 315 ; Commerce, 312 ; Simmonds Winter, 300 ; Scarlet Pearmain, 294 ; Rona, 281 ; Shepherd's Perfection, 226 ; Blenheim Orange, 200 ; Crofton, 182 ; McIntosh Red, 168 ; McMahon's White, 138 ; Duke of Clarence, 119 ; Brighton, 94 ; Senator, 80 ; Baldwin, 48 ; Cambridge Pippin, 34 ; John Sharp, 30 ; Wagner, 23 ; Frimley Beauty, 20 ; Winterstein, 20 ; Sharp's Late Red, 14 ; Mobb's Royal, 8.

GRADINGS OF BUTTER AND CHEESE, SEASON 1925–26.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelvemonth ended 31st July, 1926, were as follows :—

Butter : Salted, 59,739 tons ; unsalted, 2,818 tons : total, 62,557 tons—a decrease of 10·9 per cent. compared with the figures for the preceding twelvemonth.

Cheese : White, 47,174 tons ; coloured, 26,971 tons : total, 74,145 tons—an increase of 5·9 per cent.

In terms of butterfat, the 1925–26 amounts for butter and cheese combined represent a net decrease of 5·6 per cent. compared with those for the preceding year.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS SUFFERING FROM DEBILITY.

B. F. G., Taneatua :—

Last spring, after hard wintering, several of my cows became very poor and weak, not being able to rise after lying down, refusing to eat when fed, and dying shortly afterwards. On opening, I found attached to the walls of the "honeycomb" stomach a great number of worms—about ¾ in. long, thick, and the colour of earthworms. Lately I killed a fat heifer for beef and found the same kind of worm in her stomach. Are these worms injurious, and what is the cure?

The Live-stock Division :—

The worms found in the cows' stomachs were probably not the cause of much trouble among your animals. These parasites are very commonly seen in cattle and are not believed to cause much injury; therefore treatment for their expulsion is seldom resorted to. In the case of cows suffering from debility and poverty, however, it would be difficult to say that large numbers of such parasites had no injurious effect at all. The condition of your cows is evidently due to lack of nutritious food, and therefore we suggest that if you have no good hay or other forage crop available it is necessary to give your cows a daily ration of some supplementary food, such as a handful of bonemeal mixed with a good measure of bran or chaff. Good hay should be provided if at all possible. It will be more advantageous for you to spend time and money on providing good feed for your cows than on medicinal treatment. Thorough top-dressing of the pastures must not be overlooked, for it seems probable that your cows are suffering from a deficiency in their diet, which would be soon remedied by a course of the above-mentioned foods and liberal manuring of your land.

MIXING OF FERTILIZERS.

"Potash," South Norsewood :—

I intend using potash in addition to phosphate with my rape this year, and would be obliged if you would let me know if it can be safely mixed with either super or basic super and allowed to stand a week or so before use.

The Fields Division :—

Either of the phosphatic fertilizers mentioned may be mixed with sulphate of potash, although you will probably find that the mixture will not run quite as freely through the machine as straight super. On your class of soil we are of opinion that super would be preferable to basic super as a rape manure.

PLANTING OF WALNUT-TREES.

R. D. WILLIAMS, Otane :—

Would you kindly tell me the right time of year for planting walnut-trees; also how far apart and how deep the trees should be planted?

The Horticulture Division :—

In your locality walnut-trees may be planted up to the end of August. After that period there is a certain amount of risk of dry summer weather affecting them before they are sufficiently established. Plant the trees firmly to the same depth as they previously grew in the nursery. As the trees, when mature, have a spread of about 60 ft. diameter, they should be planted at that distance from each other if grown for the crop of nuts.

LAMBS AND KALE.

A. B., Bull's :—

Will you please inform me if lambs have ever been known to scald when feeding on Thousand-headed kale ?

The Live-stock Division :—

Although there is no direct evidence that lambs are affected by feeding on kale, we know that feed of a like nature, such as rape, does produce a systemic disturbance, so that it is possible similar results may follow too long feeding on kale. However, this is readily avoided by not leaving the lambs too long on kale alone, it being recognized that a change after a few days on this feed is essential.

LAMENESS AMONG COWS; YOUNG PIGS WITH SORE EYES.

J. P. C., Otakiri :—

(1.) Would phosphates, lime, and salt mixed make a suitable lick for dairy cows suffering from lameness ? Some seem swollen at joint just above foot, but I cannot see any open sore. Two are very lame in one hind leg. I suspect phosphate deficiency, though most of the land was top-dressed with super either last year or the year before.

(2.) I have some young pigs which develop sore eyes. The eyes discharge and eyelids stick. Some of the pigs swell across the forehead ; some die in about a week ; others recover and get all right again. Once they reach two or three weeks of age they seem immune. I feed them on whey alone. Is the diet responsible, and would molasses counteract the deficiency in whey ?

The Live-stock Division :—

(1.) It would be advisable to make quite certain that the lameness is not caused by injury to the foot, foul-in-the-foot being quite common among cows. A careful examination of the foot, especially high up between the claws, is very essential. Phosphate deficiency does sometimes produce lameness among cows when the feed is poor in quality, but it is probable that in such a case several of your cows would be exhibiting symptoms of starvation by their unthrifty appearance. If your cows are suffering from malnutrition we would advise you to supplement their feed by the addition of a ration containing a good proportion of phosphates. For this purpose a handful of steamed bonemeal fed daily in bran or chaff should soon effect an improvement. Phosphates, lime, and salt would make a good lick for cows, such lick being made up as follows : Coarse salt, 20 parts ; bonemeal, 20 parts ; slaked lime, 2 parts ; and sulphate of iron, 1 part. It is preferable, however, to give the cows a daily ration of feed rich in the necessary ingredients. Good hay should be available for all cows on short pastures at this time of the year.

(2.) With regard to the young pigs which develop sore eyes, we would suggest that there is evidence of a badly balanced ration. Whey alone is not a feed conducive to good health in pigs, especially in the case of a sow feeding a litter. Molasses are not sufficient ; the sow should be fed on skim-milk when possible, and should be given a daily allowance of pollard, maize, linseed-meal, or some equivalent, so that the young pigs may obtain a plentiful supply of good milk. The housing of young pigs should be clean and warm, a nice dry bed being essential to the rearing of strong and healthy pigs. All utensils used in the processes of feeding should be kept clean by frequent scalding, sour whey being totally unfit for sows or pigs of any description.

SOWS RUNNING WITH AN ABORTED COW.

J. BREMNER, Kokako :—

Is there any danger of sows contracting the disease if they are allowed to run in a paddock where a cow with contagious abortion has been isolated ?

The Live-stock Division :—

The cause of abortion among sows is obscure, but cases have not yet been attributed to the same specific organism as occurs in the cow. Therefore it appears that sows would not contract abortion through running in a paddock with a cow which has aborted.